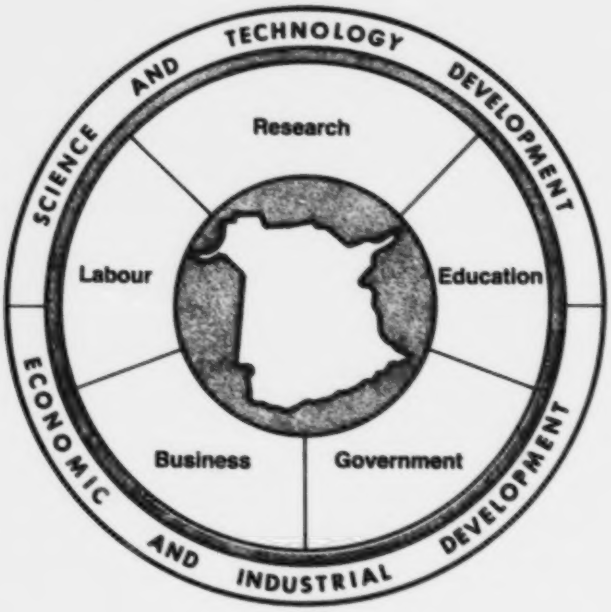
Final Report to

The Province of New Brunswick and
The Federal Government of Canada

New Brunswick's Science and Technology Strategy

This study was funded under the Canada-New Brunswick Planning Agreement.


SCIENCE AND TECHNOLOGY DEVELOPMENT
Research
Labour
Education
Business
Government
ECONOMIC AND INDUSTRIAL DEVELOPMENT

Arthur D. Little of Canada Limited

Reference 53411

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INTRODUCTION AND EXECUTIVE SUMMARY

Background

A Memorandum of Understanding on Science and Technology Initiatives has been signed between Canada and the Province of New Brunswick which takes as its objective:

> "to confirm Canada's and New Brunswick's commitment to jointly identify those Science and Technology areas which have the greatest priority for the attainment of New Brunswick's economic development goals and to work together to develop measures to help ensure that initiatives and advances take place in priority areas."

Pursuant to this Agreement, Arthur D. Little of Canada, Ltd. (ADL) has been commissioned to develop a Science and Technology Strategy for New Brunswick pursuant to guidelines developed by the Management Committee of the Canada-New Brunswick Planning Agreement.

The objective of this study has been to develop a Science and Technology strategy which will support the basic industrial development thrust in New Brunswick to strengthen, expand, and diversify the industrial base and which will focus on stimulating economic growth through encouraging the development and adoption of new technology in New Brunswick industry, particularly in the manufacturing and processing sector. Because of the large number of departments, agencies, institutions, and organizations concerned with Science and Technology issues, the strategy should serve to identify priority areas for government support, eliminate duplication of efforts, and enhance complementarity among key players.

To accomplish these objectives a three-phased study was conducted:

- Phase I - Inventory of Science and Technology Development Activities in New Brunswick and Preliminary Strategy Development
- Phase II - Analysis of Opportunities and Priorities, Strategy Development, and Implementation Planning
- Phase III - Implementation Planning Assistance

Having completed this study of science and technology strategy in New Brunswick, the Federal Minister of Regional Industrial Expansion, the Federal Minister of State for Science and Technology, the Premier of New Brunswick, and the Provincial Minister of Commerce and Development have indicated their intention to sign a five year subsidiary agreement for Industrial Innovation and Technology Development. This subsidiary agreement will complement existing subsidiary agreements in Fisheries, Forestry, Mining, Tourism, and Agriculture and will parallel an additional subsidiary agreement to be signed for Industrial Development. The purpose of the Subsidiary Agreement on Industrial Innovation and Technology Development will be:

- To provide for the coordinated implementation of those science and technology initiatives which Ministers consider to be of high priority after a review of the recommendations of the New Brunswick Science and Technology strategy and an assessment of the opportunities for economic and technological advancement facing the province; and
- To provide for the strategic planning and coordination of the science and technology policies, programs, and resources of Canada and New Brunswick and their respective agencies.

Approach

In conducting this strategy development study, ADL was guided by a Federal/Provincial Steering Committee made up primarily of representatives from relevant federal and state agencies, and an Ad Hoc Advisory Committee made up primarily of representatives of business, industry, labor, educational and research institutions, and the Industrial Development Commissions. These committees reviewed interim memoranda and drafts and met numerous times during the six-month duration of this project, providing valuable feedback and direction. Their membership is listed in Appendix G and will provide an important base for establishing the ongoing management committee and Science and Technology Council which has been recommended to oversee management and implementation of Science and Technology Strategy in the Province.

In addition to being guided by the valuable input of these two study committees, the study also benefited from discussions at a series of outreach panels and workshops which were conducted first during November/December and then again in March/April. Panels and workshops were held in Edmunton, St. Andrews, St. John, Fredericton, Moncton, Caraquet/Shippegan, Bathurst, Newcastle/Chatham and Cocogne. Participants included representatives from the Industrial Commissions, business and industry, educational and research institutions, and various government organizations. In some cases, panels focused on particular sectors (e.g. fisheries, forest products, high tech), in some cases they focused on particular subjects (e.g. technology assistance and transfer), and in some cases they focused on particular geographic regions of the Province. These panels provided very helpful input to ADL, as well as the Provincial Department of Commerce and Development (C&D) and the Federal Department of Regional and Industrial Expansion (DRIE). The results of these panels and workshops are summarized in Appendix E. These panels and the participation of the Industrial Development Commissioners will provide an important basis for the management of science and technology strategy throughout the Province to reflect the diverse and decentralized needs for opportunities for accelerated technology application and development.

As a result of input from the study committees and panels/workshops, we were also able to identify numerous technology and economic development situations which were appropriate for further investigation. To assess these situations, a series of case study interviews were conducted with selected companies, institutions and government agencies to obtain valuable perspectives on the needs and opportunities for accelerated technology application and development in the Province. A continued monitoring of these and other similar situations will provide a growing base of information that can be used to target practical and responsive initiatives to the changing science and technology needs of the Province.

Numerous previous reports and studies were also used as background for this effort, and these documents provide much of the relevant material summarized in Appendices B, C, and D on the Economic Development Science and Technology and Institutional contexts for Science and Technology strategy development in New Brunswick. Interviews were also conducted with selected provincial institutions with substantial economic development and science and technology resources and information from these interviews was also helpful in the profile summarized in Appendices B, C, and D. The ongoing maintenance of these profiles will also be helpful in assuring effective integration of science and technology strategy with economic development strategy and government reform at both the Federal and Provincial levels.

Because so many other Provinces, States, and localities have already initiated a wide range of science and technology initiatives and strategies, experience with these initiatives and lessons learned also represented an important building block for this strategy development study. This experience is summarized in Appendix F.

The last important building block in this science and technology strategy development effort was the establishment of ad hoc working groups to pursue and refine priority initiatives in six general areas:

- Technology transfer and assistance;
- New product and new venture support;
- Manufacturing and Management Technology Centres;
- Forestry and Forest Products Technology Development;
- Mineral and Material Technology Development; and
- Fisheries, Food, and Aquaculture Technology Development.

The initial inputs of these working groups is reflected in the priority initiative write-ups in Appendix A, and these working groups will provide an important base for Task Forces which will need to continue to work towards early implementation of priority initiatives in these six areas.

Strategy Development Context

The Science and Technology Strategy is recommended based upon an assessment of the strengths and weaknesses of New Brunwick's economic, science and technology resources, priority science and technology needs and opportunities, and the institutional environment within which the strategy will be implemented. These assessments suggest several consistent themes. Ten of the most important are:

1. New Brunswick's population at some 700,000 and its business community are relatively small compared to other Provinces and states. Initiatives must be tailored to reflect the relatively small size of most businesses and the Province's limited resources with respect to both people and funding.

2. Despite its relatively small social and economic base, New Brunswick has a relatively large geographic area over which this base is dispersed. As a result people, businesses, and other resources (i.e., infrastructure, educational, etc.), are unconcentrated relative to other Provinces and states. Initiatives must therefore reflect the needs for both centralized critical mass and decentralized delivery and responsiveness.

3. Economic and industrial development opportunities for New Brunswick vary widely for different economic sectors, for different types of businesses, and for different geographic areas. Science and technology initiatives generally need to be driven by economic and industrial development priorities, and management strategies need to reflect this relationship.

4. Public and private science and technology resources in a number of key areas (engineering, forestry, marine sciences, energy and minerals) are strong and are perceived as such by companies and institutions both inside and outside the Province who are familiar with them. These provide an important base upon which the Province can build.

5. Management and marketing technology resources in the Province are relatively weak and fragmented but are increasingly viewed as being critical to the competitiveness of New Brunswick companies - particularly where there is competition with companies outside the Province. These key technology capabilities will have to be significantly upgraded and integrated with the engineering and natural resource

technologies if science and technology strategy is to be most effective.

6. New Brunswick's science and technology resources are not very well linked to each other or to supporting economic development systems within the Province that could assure their growth and effective utilization in the Province. Fragmentation is a particularly serious problem in a province as small, yet as diverse as New Brunswick and there is a need for significantly improved coordination and networking.

7. With some exceptions, science and technology resources are currently not as well linked as they could be to other centers of excellence outside of the Province, and some companies view it as easier to go outside rather than through a provincial network. This can represent lost opportunities for building provincial capabilities and the Province needs to better utilize outside capabilities to complement and build its strengths.

8. Research and development expenditures in the Province are relatively limited ($210 per employee compared to $428 per employee average in Canada. In addition, private sector R&D represents only 10% of the total compared to 46% in Provinces such as Ontario. Overall R&D expenditures need to be increased in New Brunswick and government expenditures need to be leveraged more effectively to achieve improved performance in technology development and application.

9. Many companies are not familiar with the Province's science and technology resources and perceive them as having an overly academic inclination and as not being responsive to practical science and technology needs of New Brunswick companies. This perception has severely limited the critical role of business in supporting the development of the Province's resources and future initiatives need to be both practical and responsive for the Private Sector.

10. Science and technology resources have not enjoyed consistent or stable support from either government or the private sector, and constant uncertainty has diverted energies away from important technology building and development objectives. Strong leadership and private/public partnerships will be needed to take better advantages of existing resources and opportunities.

These themes have important implications for the Province's ability to more effectively capitalize on science and technology and to achieve the economic development goal of improved job and business opportunities.

Recommended Science and Technology Strategy

Exhibit I illustrates the overall strategic framework which is recommended in this study:

The overall objective or goal of the recommended Science and Technology Framework reinforces the critical linkage between science and technology strategy and economic development -- that is, to accelerate development and application of technology to increase and enhance employment opportunity in the Province. This should be achieved by:

- Stimulating and assisting local entrepreneurs in establishing and expanding enterprises based on new or advanced technologies in the Province;
- Attracting into the Province manufacturing and business service firms that offer significant long term prospects for employment based upon emerging technologies;
- Transferring technologies to existing industries in New Brunswick in support of improved productivity and competitiveness of successful new products and ventures;
- Attracting into the Province and strengthening existing applied research and development enterprises.

The overall Economic Development Goal reflects the persistently high rate of unemployment in New Brunswick -- that is, To Increase Employment, Business and Earnings Opportunities for New Brunswick residents and to Reduce Existing Unemployment Levels and Dependence on Federal Transfer Payments. As stated in the strategic objectives contained in the Canada/New Brunswick Economic and Regional Development Agreement (ERDA), this should be achieved by

- Improving the productivity and competitive position and where possible expanding the output of the Province's primary resource and resource-based manufacturing industries;
- Increasing the processing of the Province's resources;
- Diversifying the industrial base by encouraging the growth of the secondary manufacturing and services sector with particular emphasis on goods and services embodying new and emerging technologies;
- Ensuring that each region of the Province makes its maximum potential contribution to provincial economic growth given its relative economic strengths with particular emphasis on those regions where economic disparities are must pronounced;

The five recommended Science and Technology strategies illustrated in Exhibit I are discussed further in Chapter I and reflect the conclusion that achievements of technology and economic development objectives will require a four-pronged program strategy supported by an effective management strategy.

The four recommended program strategies and their strategy components are:

A. Strengthen the Support System for Innovation, Entrepreneurship and Technology Development

  - Provide technical assistance to meet the needs of business;
  - Target financial support for technology development and application;
  - Create a climate conducive to entrepreneurship innovation and technology application;

B. Support the Development of Technology-Based Industries in the Province

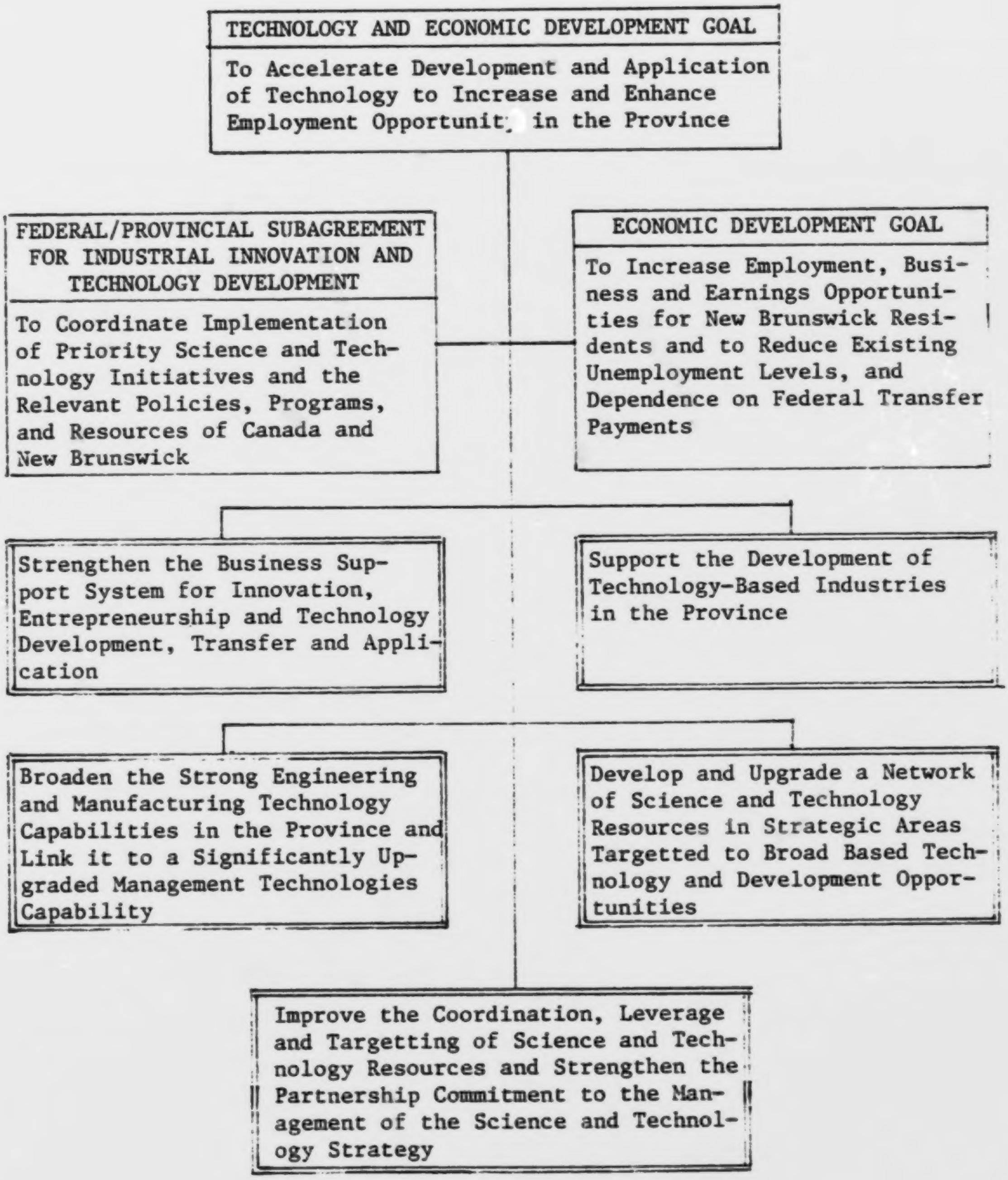
C. Strengthen Engineering, Manufacturing and Management Technology Resources

  - Establish a manufacturing and management technology council;
  - Strengthen manufacturing technologies centres;
  - Strengthen centres for application and development of microelectronics;
  - Establish a new initiative in management information systems and technologies;
  - Establish a new initiative in Systems Engineering and integration.

D. Develop and Upgrade the Province's Science and Technology Resources in Targeted Areas

  - Strengthen and focus forestry and wood products technology development efforts;
  - Strengthen and focus minerals and materials technology development efforts;
  - Strengthen and focus fisheries, aquaculture and food technology development efforts;
  - Establish a technology development forum.

EXHIBIT I RECOMMENDED STRATEGIC PLANNING FRAMEWORK FOR SCIENCE AND TECHNOLOGY IN NEW BRUNSWICK



TECHNOLOGY AND ECONOMIC DEVELOPMENT GOAL

To Accelerate Development and Application of Technology to Increase and Enhance Employment Opportunity in the Province

FEDERAL/PROVINCIAL SUBAGREEMENT FOR INDUSTRIAL INNOVATION AND TECHNOLOGY DEVELOPMENT

To Coordinate Implementation of Priority Science and Technology Initiatives and the Relevant Policies, Programs, and Resources of Canada and New Brunswick

ECONOMIC DEVELOPMENT GOAL

To Increase Employment, Business and Earnings Opportunities for New Brunswick Residents and to Reduce Existing Unemployment Levels, and Dependence on Federal Transfer Payments

Strengthen the Business Support System for Innovation, Entrepreneurship and Technology Development, Transfer and Application

Support the Development of Technology-Based Industries in the Province

Broaden the Strong Engineering and Manufacturing Technology Capabilities in the Province and Link it to a Significantly Upgraded Management Technologies Capability

Develop and Upgrade a Network of Science and Technology Resources in Strategic Areas Targetted to Broad Based Technology and Development Opportunities

Improve the Coordination, Leverage and Targetting of Science and Technology Resources and Strengthen the Partnership Commitment to the Management of the Science and Technology Strategy

The Science and Technology Management Strategy is

E. To Improve the Coordination, Leverage and targeting of Science and Technology Resources and to Strengthen the Partnership Commitment to the Management of the Science and Technology Strategy

- Assure effective coordination, leverage, and commitment of Federal/Provincial and public/private partnerships in Science and Technology;
- Provide for clear focusing of resources and capabilities on entrepreneurship, innovation, technology assistance and transfer, and key industry/technology targets.

The priority initiatives that follow are tailored to reflect these themes.

Priority Program Initiatives

To implement the four program strategies outlined above, twenty-one priority initiatives are recommended for implementation.

Strategy A. Strengthen the business support system for innovation, entrepreneurship and technology development, transfer and application in the Province through:

A-1 An expanded technology assistance program;

A-2 Upgraded marketing and export assistance;

A-3 Upgraded business management and planning assistance;

A-4 A program of matching grants for applied research;

A-5 Increased support for technology demonstration programs;

A-6 Strengthened and more focused start-up assistance and seed capital for new products and new ventures;

A-7 An expanded and more effective venture capital support program;

A-8 Enterprise and product development support and innovation centres;

A-9 An Entrepreneurship Awareness and Development Program.

Strategy B Support the development of technology-based industries in the Province through Federal/Provincial procurement policies, external marketing targets, and supporting service sector expansion.

B-1 Expanded service sector eligibility in support programs;

B-2 Expanded use of procurement/offsets targeted to build technology-based industry;

B-3 Marketing and promotion efforts directed to technology based industry.

Strategy C Broaden the strong engineering and manufacturing technology capabilities within the Province and link it to an upgraded management technologies capability through:

C-1 A management and manufacturing technologies council;

C-2 Strengthened manufacturing technology centres;

C-3 A strengthened centre for applications and development of microelectronics;

C-4 A new initiative in management information systems and technologies;

C-5 A new initiative in systems engineering and integration.

Strategy D Develop and upgrade a network of science and technology resources in strategic areas targeted to broad-based technology and development opportunities through:

D-1 Forestry and wood products technology development related to the Maritime forestry complex;

D-2 Mineral and material technology development building on RPC's experience;

D-3 Fisheries, food and aquaculture technology development;

D-4 Periodic Technology Development Forum to identify emerging technology development and application alternatives.

Each of these priority Science and Technology Initiatives is described in Chapter II and further detail on the six areas of highest priorities is provided in Appendix A. These six highest priority areas will each require further refinement and resource allocation recommendations by recommended Task Forces established to continue the work of the ad hoc working groups. These six areas are:

- Technology transfer and assistance;
- New Product and new venture support;
- Management and manufacturing technology centres;
- Forestry and forest product technology development;
- Mineral and material technology development; and
- Fisheries, food and aquaculture technology development.

Priority Management Initiatives

In order to strengthen the management of science and technology resources in New Brunswick, ten priority management initiatives are recommended:

E-1 Establishment of a broad-based Federal/Provincial Management Committee to oversee a five year subsidiary agreement for Industrial Innovation and Technology Development;

E-2 Establishment of a New Brunswick Science and Technology Council to provide a strong advisory and leadership role in Science and Technology Strategy implementation and management of the subsidiary agreement;

E-3 Establishment of a Technology and Economic Development Branch within the New Brunswick Department of Commerce and Development to lead and coordinate Provincial science and technology initiatives and to provide staff support to the management committee and dedicated staff support to the Science and Technology Council;

E-4 Establishment of a RPC Contract Office of Technology Assessment, Assistance and Transfer;

E-5 Establishment of a Contracted Enterprise and Product Development Support Office or Corporation;

E-6 Broadened Manufacturing and Management Technology Centres with consolidated management of MTC and CADMI;

E-7 Creation of Industry/Technology Task Forces and Development Initiatives;

E-8 Designation of university and laboratory technology transfer agents and establishment of an effective association/network to serve as an important resource to the RPC Office of Technology Assessment, Assistance and Transfer, and to provide input to the Technology and Economic Development Branch, the Science and Technology Council, the Management Committee and others on technology assistance and transfer activities;

E-9 Strengthened support and broadened missions for Industrial Development Commissions in implementation of Science and Technology strategy and the subsidiary agreement on Industrial Innovation and Technology Development;

E-10 Broadened flexibility and strengthened support for the Research and Productivity Council.

These priority management initiatives are discussed further in Chapter III. Exhibit II illustrates the primary management and leadership responsibilities recommended for each of the twenty-one priority Science and Technology program initiatives outlined earlier. Exhibit III illustrates the overall concept of a New Brunswick Science and Technology Strategy driven by the Province's Economic Development Strategy and effectively managed by a partnership of Government, Labour, Research and Education Institutions, and Business and Industry.

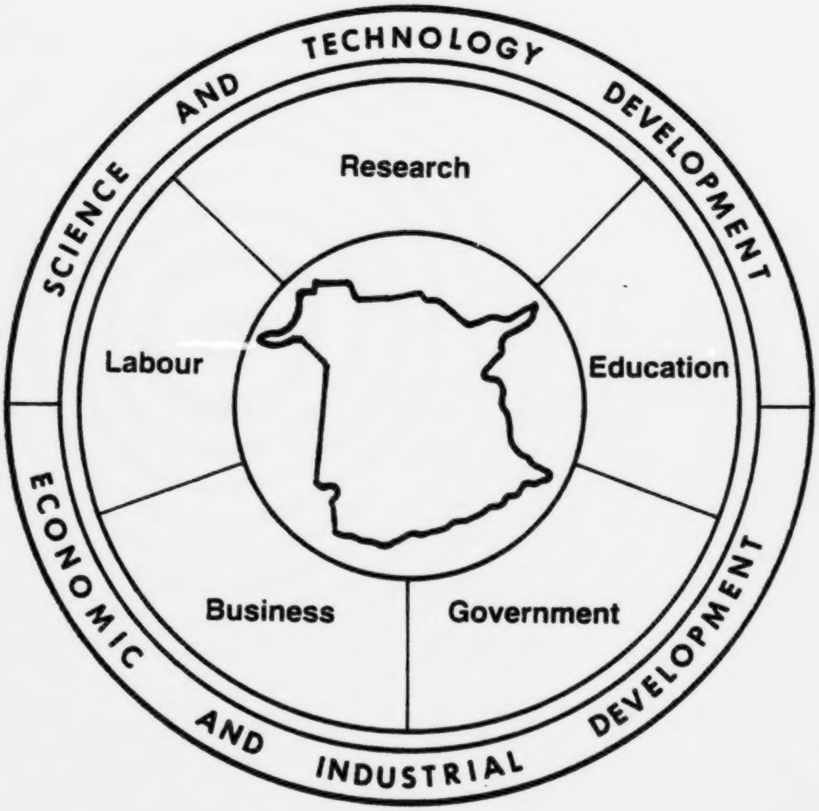
EXHIBIT II

RELATIONSHIP BETWEEN PRIORITY PROGRAM INITIATES AND MANAGEMENT INITIATIVES

	Provincial Commerce & Devlmt. Staff & Mgmt. Respon.				Focused Leadership & Development Responsibility Through the Science and Technology Council			
		Technology & Economic Development						
Priority Program Initiatives	Industry & Business Services	Economic Development	Planning	Science & Technology	Office of RPC Tech. Asst. Asst. & Trans. & Tech Trans. Agents	Enterprise & Product Development Support Task Force & Office	Manuf. & Mgmt. Tech. Council & Task Force	Ind/Tech Development Task Forces & Councils
A1. Expanded Technology Assistance Program				X	X			
A2. Upgraded Marketing and Export Assistance	X					X		
A3. Upgraded Business Mgmt. and Planning Assistance Program	X					X		
A4. Matching Applied Research Grants				X	X			
A5. Technology Demonstration Programs				X	X			
A6. Start Up Assistance and Seed Capital Support	X					X		
A7. Expanded Venture Capital Support Program	X					X		
A8. Enterprise and Product Development Support (Innovation Centers)	X			X		X		
A9. Entrepreneurship Awareness and Development Program						X		
B1. Expanded Service Sector Eligibility in Support Programs		X						X
B2. Procurement/Offset Policies Targeted to Build Technology Based Industry	X							X
B3. External Marketing Efforts Targeted to Technology Based Industry	X							X
C1. Management Manufacturing Technologies Council				X			X	
C2. Manufacturing Technology Centre				X			X	
C3. Centre for Applications and Development of Microelectronics				X			X	
C4. Management Information Systems and Management Technologies				X			X	
C5. Systems Engineering and Integration				X			X	
D1. Forestry & Wood Products Technology Development		X		X				X
D2. Mineral & Material Technology Development		X		X				X
D3. Fisheries, Food & Aquaculture Technology Development		X		X				X
D4. Technology Development Forum		X		X				X

EXHIBIT III

OVERALL CONCEPT FOR NEW BRUNSWICK SCIENCE AND TECHNOLOGY STRATEGY


SCIENCE AND TECHNOLOGY DEVELOPMENT
Research
Labour
Education
Business
Government
ECONOMIC AND INDUSTRIAL DEVELOPMENT

CHAPTER I

RECOMMENDED STRATEGIC FRAMEWORK

New Brunswick's Science and Technology Strategy has been developed to support this strategy by achieving three objectives, as stated in the Canada/New Brunswick Memorandum of Understanding on Science and Technology Initiatives:

(1) To improve the competitiveness of existing industry;

(2) To diversify the industrial base through the attraction of new ventures to the Province, and to provide assistance to existing manufacturers, to innovate and diversify and to local entrepreneurs to establish ventures;

(3) To increase the in-Province capability in technological development, innovation and diffusion in areas of strategic importance to New Brunswick, thus creating employment in industrial R&D.

To achieve the above objectives, five strategic thrusts are recommended, as shown in Figure I-1:

(A) Strengthen the business support system for innovation, entrepreneurship and technology development and application in the Province.

(B) Support the development of technology-based industries in the Province.

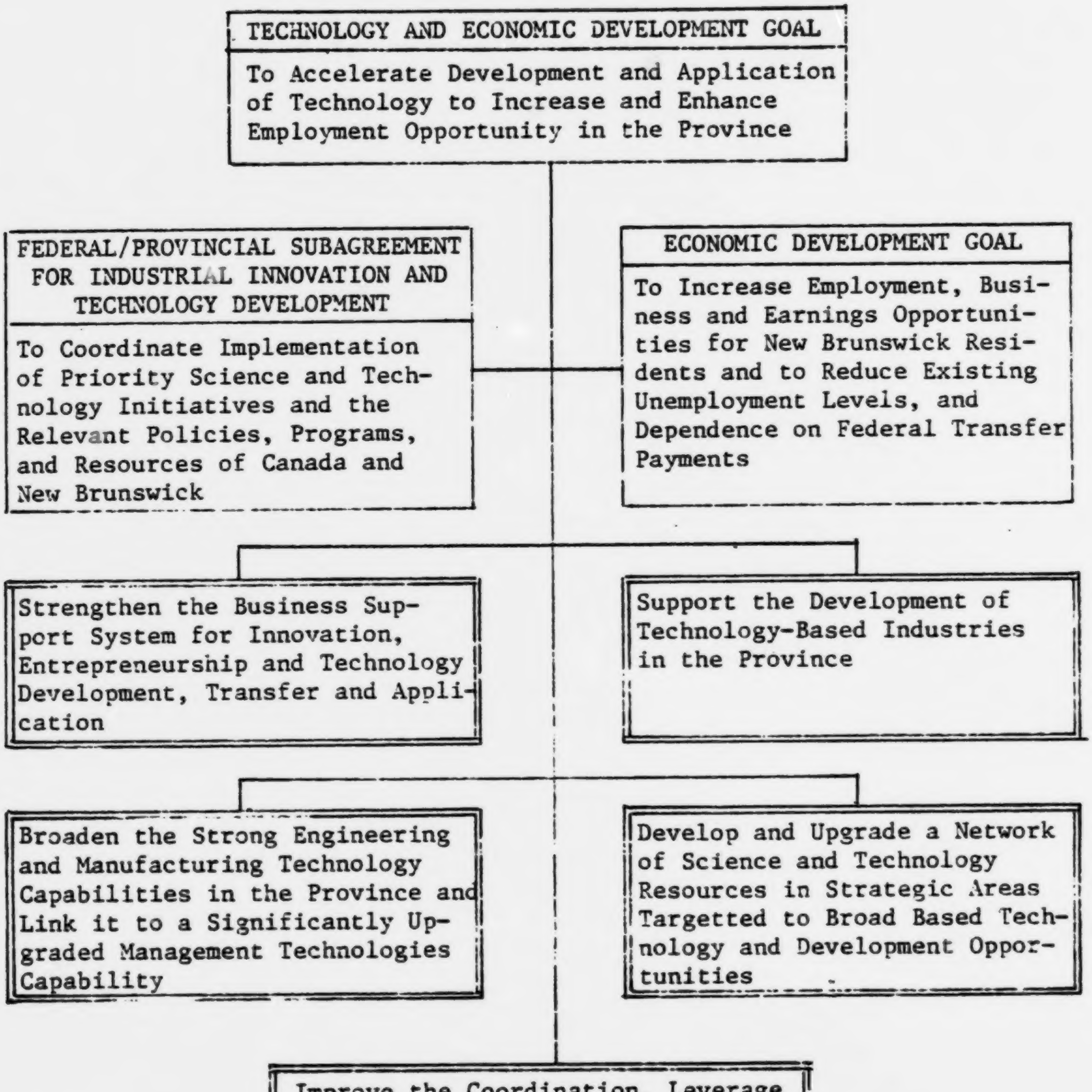
(C) Strengthen engineering and manufacturing technology capabilities within the Province and link it to an upgraded management technologies capability.

(D) Develop and upgrade a network of science and technology resources in strategic areas targeted to broad-based technology and development opportunities.

(E) Improve the management of science and technology resources in New Brunswick.

These strategic thrusts are based upon analyses of New Brunswick's economy and science and technology resources, the priority needs and opportunities in the Province, and a series of panel discussions, interviews, and strategic workshops. This chapter outlines each of the five strategic thrusts, focusing on priorities.

FIGURE I-1 RECOMMENDED STRATEGIC PLANNING FRAMEWORK FOR SCIENCE AND TECHNOLOGY IN NEW BRUNSWICK



TECHNOLOGY AND ECONOMIC DEVELOPMENT GOAL

To Accelerate Development and Application of Technology to Increase and Enhance Employment Opportunity in the Province

FEDERAL/PROVINCIAL SUBAGREEMENT FOR INDUSTRIAL INNOVATION AND TECHNOLOGY DEVELOPMENT

To Coordinate Implementation of Priority Science and Technology Initiatives and the Relevant Policies, Programs, and Resources of Canada and New Brunswick

ECONOMIC DEVELOPMENT GOAL

To Increase Employment, Business and Earnings Opportunities for New Brunswick Residents and to Reduce Existing Unemployment Levels, and Dependence on Federal Transfer Payments

Strengthen the Business Support System for Innovation, Entrepreneurship and Technology Development, Transfer and Application

Support the Development of Technology-Based Industries in the Province

Broaden the Strong Engineering and Manufacturing Technology Capabilities in the Province and Link it to a Significantly Upgraded Management Technologies Capability

Develop and Upgrade a Network of Science and Technology Resources in Strategic Areas Targetted to Broad Based Technology and Development Opportunities

Improve the Coordination, Leverage and Targetting of Science and Technology Resources and Strengthen the Partnership Commitment to the Management of the Science and Technology Strategy

Between 1971 and 1984 New Brunswick's labor force increased from 209,000 to 291,000, a total *increase of 39* percent. The economy, however, was not able to provide an equivalent growth in new job opportunities. Consequently the unemployment rate increased steadily over this period and was at 15.5 percent in May, 1985.

The economic base is dominated by the service sector, which accounted for 68 percent of all employment in the Province based upon the most current, complete employment statistics (1981). The balance of the Province's economic base is dominated by the primary industries of forestry, agriculture, fishing and mining, and manufacturing industries directly associated with them (see Figure I-2).

Throughout the Province, there is a significant seasonal variation in total employment. This seasonal variation has become more marked in recent years in manufacturing sectors. Despite a recent recovery in the peak levels of employment, base employment levels have continued to decline over the last four years.

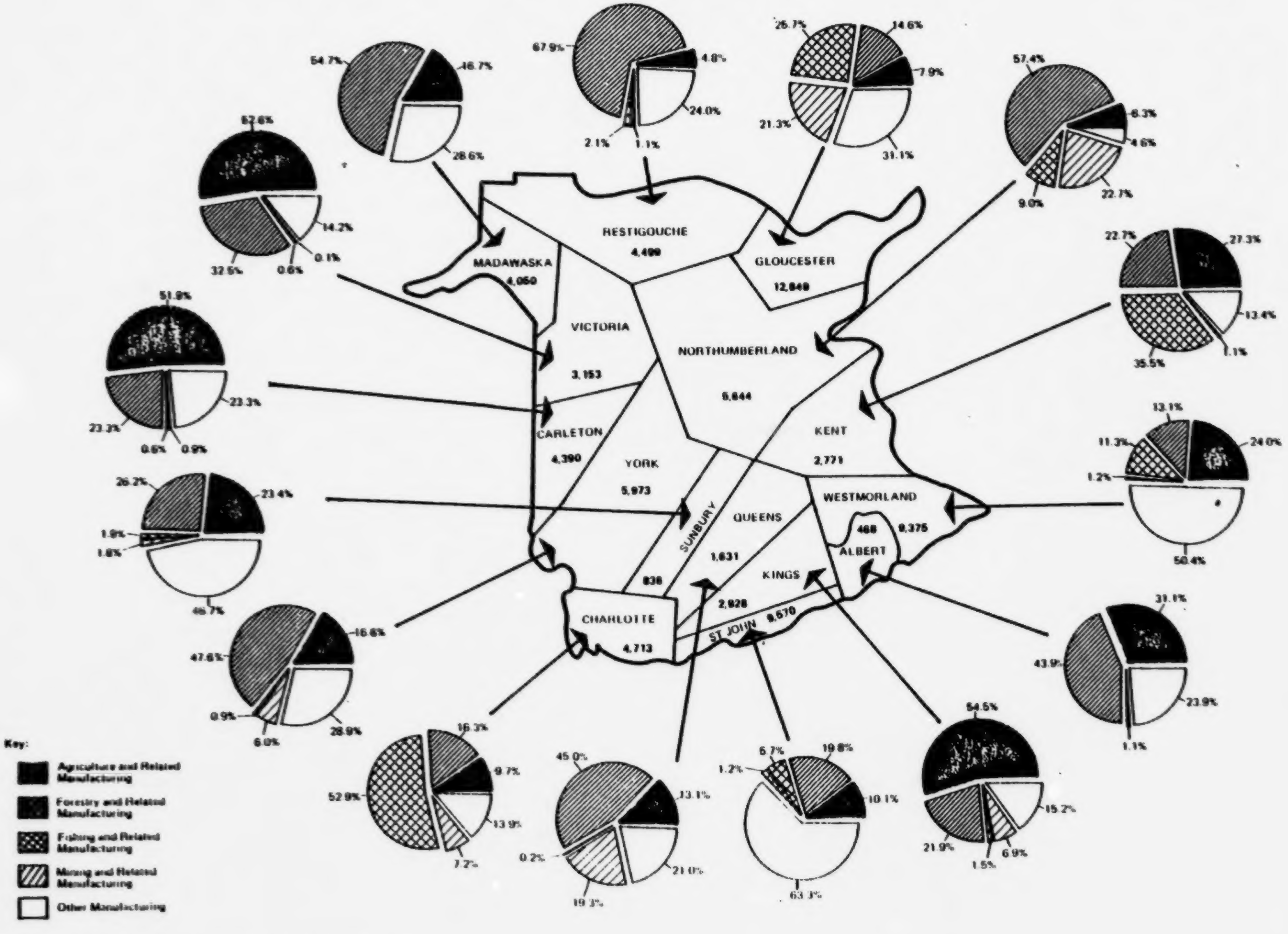
The distribution of employment as a whole and by sector is not geographically evenly. In each of the primary sectors and their associated manufacturing industries there is concentration of employment in specific areas of the Province.

To reflect the characteristics of New Brunswick's economy, the Industrial Innovation and Technology Development Agreement suggests the following:

> "The strategic objectives and goals contained in the Canada/New Brunswick Economic and Regional Development Agreement (ERDA) are:
>
> a) To improve the productivity and competitive position and where possible expand the output of the Province's primary resource and resource based manufacturing industries;
>
> b) To increase the processing of the Province's resources;
>
> c) To diversify the industrial base by encouraging the growth of the secondary manufacturing and services sector with particular emphasis on goods and services embodying new and emerging technologies;
>
> d) To ensure that each region of the Province makes its maximum potential contribution to provincial economic growth given its relative economic strengths with particular emphasis on those regions where economic disparities are most pronounced.
>
> The overall priority of the development strategy to the ERDA remains the creation of new viable permanent jobs. With the exception of mining, the resource sectors do not offer the potential for significant employment creation."

FIGURE 1-2

AGRICULTURE, FORESTRY, FISHING, MINING AND RELATED MANUFACTURING
AS PERCENTAGES OF TOTAL PRIMARY AND SECONDARY EMPLOYMENT
IN NEW BRUNSWICK
1981


RESTIGOUCHE
4,499
GLOUCESTER
12,849
MADAWASKA
4,050
VICTORIA
3,153
NORTHUMBERLAND
6,644
CARLETON
4,390
YORK
5,973
KENT
2,771
WESTMORLAND
9,375
SUNBURY
838
QUEENS
1,631
ALBERT
468
KINGS
2,928
ST JOHN
9,670
CHARLOTTE
4,713
67.9%
4.8%
24.0%
1.1%
2.1%
54.7%
16.7%
28.6%
62.6%
14.2%
0.1%
0.6%
32.5%
51.9%
23.3%
0.9%
0.6%
23.3%
26.2%
23.4%
1.9%
1.8%
46.7%
47.6%
16.6%
28.9%
6.0%
0.9%
16.3%
9.7%
13.9%
7.2%
52.9%
45.0%
13.1%
21.0%
19.3%
0.2%
5.7%
19.8%
10.1%
63.3%
1.2%
54.5%
15.2%
6.9%
1.5%
21.9%
31.1%
23.9%
1.1%
43.9%
13.1%
24.0%
50.4%
1.2%
11.3%
22.7%
27.3%
13.4%
1.1%
35.5%
57.4%
6.3%
4.6%
22.7%
9.0%
25.7%
14.6%
7.9%
31.1%
21.3%
Key:
Agriculture and Related Manufacturing
Forestry and Related Manufacturing
Fishing and Related Manufacturing
Mining and Related Manufacturing
Other Manufacturing

Numbers represent total primary and manufacturing employment per county

New Brunswick already has in place a number of institutions which are specifically promoting science and technology. These range from government initiated institutions such as the RPC, to the universities in the Province, to smaller industry-specific institutions such as the Atlantic Salmon Research Institute, and the Peat Institute. They all conduct some level of applied research directly associated with a specific industry or a range of the primary and manufacturing industries in the Province. In accordance with their missions and goals, most of their work is focussed on a New Brunswick clientele. Selected institutions, such as the Research and Productivity Council (RPC) or the Atlantic Salmon Research Institute, have conduct research work with more of an international focus.

These institutions have developed varying degrees of networks, both within the Province and with other research institutions in Canada and internationally. In several instances these networks have been formalized, notably with the formation of the Manufacturing Technology Center, which involves input from the RPC, the universities and community colleges, and with CADMI Inc., which involves University of New Brunswick and Universite de Moncton. A strong network exists between the institutions that conduct research in the fishing and aquaculture industry. The latter have a long record of cooperation among themselves, and with Federal and American fishing related research institutions. Networks involving participants from outside New Brunswick and not so well developed in the cases of the other institutions.

To capitalize on these resources and to reflect needs, the Industrial and Technology Development Agreement "would accelerate the development and application of technology in order to increase and enhance employment in the Province through the:

(1) Stimulation and assistance of local entrepreneurs in establishing and expanding new, advanced technology enterprises in the Provinces;

(2) Attraction into the Province of manufacturing and business services firms that offer significant long-term prospects for employment, based upon emerging technologies;

(3) Attraction into the Province and strengthening of existing applied research and development enterprises; and

(4) Transfer of technology to existing industries in New Brunswick>"

A. STRENGTHEN THE SUPPORT SYSTEM FOR INNOVATION, ENTREPRENEURSHIP AND TECHNOLOGY DEVELOPMENT

The Province needs to create an environment more conducive for the development and application of science and technology by businesses throughout New Brunswick. Improvement in support systems should focus on meeting the needs of both existing New Brunswick industries and potential entrepreneurs and start-ups. In particular, the support system should be oriented toward New Brunswick's natural resource base in:

- Forest products;
- Agriculture;
- Fishing and marine resources; and
- Minerals.

While processing industries generally have adequate supplies of high quality natural resources, their ability to grow is hampered by two factors: 1) the relatively small size of the New Brunswick market that uses their products and services and 2) the numerous barriers that hinder their competing effectively outside of the Province. Among the factors which affect New Brunswick's facilities ability to compete are: the application of new process and product technologies to improve resource extraction and processing; product quality; productivity; the willingness to innovate and pursue entrepreneurial endeavors; the ability to manage technology and related resources in a changing or growing business environment; the ability to identify new markets and pursue an effective entry strategy; access to financial resources; the quality of educational and technical training resources, and the extent to which they are keeping pace with changing needs.

Three strategies are recommended to achieve this strategic thrust. Each is outlined in brief below.

1. Provide Technical Assistance to Meet the Needs of Business

The provision of technical assistance to businesses in New Brunswick should be considered a high priority. New Brunswick's technical assistance programs tend to be underfunded. Some geographical areas are better served than others by existing programs--as are some priority industries and technologies. However, they do provide a solid base to build on. The Province should build on existing programs. There is a need to improve a) links between businesses and available support services and b) expertise within the Province and elsewhere. This will require establishing effective networks and undertaking active outreach efforts.

In particular, technical assistance programs should focus on:

- Improving business and industry's access to technological expertise and strengthening technology transfer mechanisms;

- Strengthening the capability in and access to marketing expertise, particularly to assist small business and entrepreneurs entering national and foreign markets;

- Improving access to business expertise for small businesses and entrepreneurs, particularly in planning, management and financial assistance;
- Assisting small and medium-sized businesses with the often complicated tasks of applying for government assistance and dealing with government regulations; and
- Improving access to information on science and technology, economic development support programs, and related information.

2. Create a Climate Conducive to Entrepreneurship, Innovation, and Technology Application

New Brunswick must establish an environment which stimulates and supports entrepreneurship, innovation, technology application and risk-taking within existing industries and research institutions. Starting within the educational systems, New Brunswickers must be introduced to a creative environment which encourages the challenging of existing ideas and the process of innovation. Traditionally adverse to risk taking, New Brunswickers must be consistently encouraged to consider and undertake new risks and to pursue new ideas.

The business community has an important role to play in this regard. Within existing facilities, businesses should establish incentive structures to reward innovation at all levels of operation. Numerous models can be drawn upon, such as "quality circles" to enhance product quality and improve productivity, and modest capital support programs to support innovative ideas.

Beyond the company setting, the private sector can take steps to provide support to entrepreneurs and innovators. For example, within a community or region, medium sized and larger businesses--including those within the financial community--can hold regular luncheons or meetings to review a proposed opportunity and business plan with an entrepreneur and/or to provide seminars or discussion forums for topics related to starting up and running a business.

The objectives of this strategy are 1) to encourage entrepreneurship and innovation and 2) to generate new business opportunities through the development and application of technology.

3. Target Financial Support for Technology Development and Application in New Brunswick

New Brunswick and the Federal Government presently provide substantial financial support for industrial development in the Province. The level of financial support appears to be adequate. However, it should be targeted to promote technology development and application associated with the following economic development opportunities:

- Development of new and expanding markets for traditional resource-based industries;
- Development of value-added and supplier sourcing opportunities in existing products related to New Brunswick's resource based industries;
- Development of new businesses associated with high technology industries and the service sector; and
- Attraction of inward investment into New Brunswick, consistent with the Province's comparative advantages as a location.

Special attention needs to be focused on developing expanded resources and a network of private venture and public/private seed capital. This area represents one of the Province's greatest needs, particularly in terms of new technology development opportunities. While the IRDP program was revised to make participation easier, guidelines and requirements associated with other financial assistance should be clearly defined for potential users.

New Brunswick must aggressively promote applied research, the transfer of technology, and commercialization of new ideas within and between research centers and businesses within the Province. A particular emphasis must be placed on "tailoring" existing technologies from outside the Province to the unique requirements of New Brunswick industry. In many cases, New Brunswick businesses, particularly those that are small- and medium-sized have smaller scale markets, different resource input characteristics, or other operating factors which must be considered when applying a technology "tried and tested" in another environment.

Programs are needed to strengthen and reinforce interaction between business and technology expertise in addressing these special concerns. Most importantly, these programs must provide efficient mechanisms for channeling and responding to technology inquiries and linking targeted technology resources with targeted industries and businesses. Specific initiatives which are high priority and require new or substantially increased commitment of resources include:

- Innovation centres and support service to provide for the establishment of networks of assistance and shared support services, existing facilities (particularly with excess capacity) and experience.
- A product development corporation to establish a vehicle for focusing business and technical assistance and financial support on new product and market ideas with significant potential.

- Matching grants in applied research to encourage more private industry participation from private industry, institutions and universities in targeted industry technology areas in the Province. This should be targeted to those who cannot take advantage of existing R&D tax credits. The Province should provide 50-50 matching grants to stimulate applied research investment--the effort should be targeted to individuals with ideas in the earliest stages of conception.

- Technology demonstration programs to demonstrate the benefits of technology application in key industries with multiple participants (be it sawmills or fish processors).

To implement these strategies, a combination of initiatives are required. Some of the action implications identified above represent a continuation and strengthening of current efforts. Six initiatives will require commitment of new or substantially increased efforts or resources. These are:

1. Expanded technology assistance;
2. Upgraded marketing and export assistance;
3. Upgraded business management and planning assistance;
4. Matching research grants;
5. Technology demonstration programs;
6. Start-up assistance and seed capital;
7. Expanded venture capital resources;
8. Enterprise and product development support; and
9. Entrepreneurship awareness and development program.

B. SUPPORT THE DEVELOPMENT OF TECHNOLOGY-BASED INDUSTRIES IN THE PROVINCE

Because of the relatively small size of its industrial base, New Brunswick must continue to strengthen its efforts to promote inward investment. This is an effective means for bringing external technology expertise and industrial activity into the Province and will contribute to a strengthened technology base.

This objective is consistent with marketing and promotional activities aimed at achieving the Province's economic development goals. In addition, inward investment is a priority for facilitating and translating technology transfer from centers of excellence outside the Province to companies and opportunities within the Province. Examples of such industries in New Brunswick illustrate the potential benefits, for instance, Scandinavian investors in aquaculture and peat.

The Province should pursue this strategic thrust through three avenues:

1. Expand the eligibility requirements of business support programs (SIFAP, IRDP, etc.) and services to include selected service sector businesses.

2. Use Federal/Provincial procurement and offset policies to pursue investment opportunities that will provide a market base for technology intensive New Brunswick companies (recent military radar programs are a good example).

3. Actively promote and market the Province as a location for technology-based companies.

C. STRENGTHEN ENGINEERING, MANUFACTURING, AND MANAGEMENT TECHNOLOGY RESOURCES

To more fully capitalize on the Province's natural resources, manufacturing, and service sector industry opportunities, New Brunswick must strengthen its resources in engineering, manufacturing and management technologies and more effectively network these to each other to the compliment resources outside the Province, particularly those at NRC and to the needs of the private sector. The Province has a good base upon which to build in this regard--among its resources are MTC, CADMI, RPC, University of New Brunswick (in engineering sciences and business), Universite de Moncton and the community colleges. Many businesses are unaware of the full potential of these resources. In some cases, the resources themselves need to be upgraded.

Two types of priority initiatives will require new or increased commitment of resources:

- Broaden the engineering technology capability at MTC and CADMI to achieve education, training and economic and technology development objectives. The Province will continue to upgrade the equipment and training available at MTC (particularly at UNB, UdeM and RPC) in terms of CAD/CAM as well as quality assurance/testing and engineering systems;

- Upgrade management and communication technologies to improve the competitiveness of many of the Province's businesses, particularly those operating in an export or rapidly changing market. Business will probably be at least as affected by the effectiveness and appropriateness of their management and communication technologies as by engineering technologies. This initiative will provide the basis for a major effort of the Province over the next five years to upgrade the technology capability and equipment available at UdeM, UNB and the community colleges. Faculty training/retraining and equipment will address important education and training needs of the Province as well as needed business support services for local businesses.

Specifically, five initiatives should be pursued:

1. A Management and Manufacturing Technologies Council;
2. Strengthened Manufacturing Technology Centres;
3. A Strengthened Centre for Applications and Development of Microelectronics;
4. A new initiative in Management Information Systems and Technologies; and
5. A new initiative in Systems Engineering and Integration.

D. DEVELOP AND UPGRADE THE PROVINCE'S SCIENCE AND TECHNOLOGY RESOURCES AND DEVELOPMENT INITIATIVES IN TARGETED AREAS

Given New Brunswick's size and limited financial and human resources, the Province can not realistically expect to achieve a level of excellence in a broad range of Science and Technology areas. The Province must target and develop Science and Technology resources in a few selected strategic areas. New Brunswick's natural resources, particularly in forestry, fishing, agriculture and mining (e.g., peat and zinc) are recognized within the Maritimes for their quality. However, New Brunswick's capacity to process, utilize and convert these resources into value-added products has not been highly developed across different industrial sectors and geographical areas. New Brunswick's science and technology resource base, particularly as it relates to downstream processing activities, must be upgraded to a competitive position within the Maritimes.

In other areas, it will be more efficient for New Brunswick's research and industrial communities to draw upon the expertise and resources of institutions and individuals beyond New Brunswick's borders.

An enhanced science and technology base within New Brunswick will be a vital resource for the growth and competitive survival of New Brunswick's industries and businesses. To strengthen this resource, New Brunswick must establish and maintain a nationally recognized state-of-the-art excellence in three to four key areas. Given available, but admittedly limited, public and private sector resources, private and public leaders should choose targets for research and technology development related to New Brunswick's specific opportunities in:

1) Forestry and forest products technologies;
2) Fishing, marine and food technologies;
3) Minerals and materials technologies.

Five initiatives we recommended to develop these selected areas:

- Target support to New Brunswick's universities and research institutions to strengthen these fields of expertise. Direct funding toward basic and applied research and development projects in target areas.
- Host an annual technology forum to identify emerging technology development opportunities which can be potential targets of initiative support in later years.
- Establish stronger interactive links between the private sector and the science and technology expertise at different institutions (universities, government, research laboratories and private research facilities). These linkages should address the technological needs that are common to a variety of natural resource-related opportunities.
- Strengthen the partnership between the private sector and the technology research university. In particular, efforts should be directed toward small and medium-sized businesses who need technical assistance in acquiring and tailoring available technologies to their particular operations.
- Encourage collaborative research, development and technology application projects.
- Support should be targeted to strengthen these fields of expertise in New Brunswick's universities and research institutions. In these target areas, funding should be directed toward basic and applied research and development projects.
- The Province should also host an annual technology forum to identify emerging technology development opportunities which can be potential targets of initiative support in later years.
- Steps should be taken to establish stronger interactive linkages between the private sector and the science and technology expertise at different institutions (universities, government research laboratories and private research facilities). These links should address the technological needs that are common to a variety of natural resource-related opportunities.
- Collaborative research, development and technology application projects should be encouraged in priority technology development areas.

Steps are needed to strengthen the partnership between the technology research community and the private sector. In particular, efforts should be directed toward smaller and medium-sized businesses which need technical assistance in acquiring and tailoring available technologies to their particular operations.

E. IMPROVE THE COORDINATION, LEVERAGE, AND TARGETING OF SCIENCE AND TECHNOLOGY RESOURCES AND STRENGTHEN THE PARTNERSHIP COMMITMENT TO THE MANAGEMENT OF THE SCIENCE AND TECHNOLOGY STRATEGY

New Brunswick must establish a strong and sustained commitment to implementing the science and technology strategy. Because of limited resources and an increasingly competitive environment, a high priority for the overall strategy will be to maximize the effective utilization of available resources and the respective capabilities of key involved groups. This is particularly important in the context of New Brunswick's broader economic development strategy.

The commitment to the science and technology strategy must involve the key institutions of government--both Provincial and Federal--the business community, labor, the universities and other research institutions.

In addition to numerous traditional economic development efforts and programs, New Brunswick has a number of resources and programs oriented towards science and technology. Primarily these are the Manufacturing Technology Center (MTC), the Center for Applications and Development of Microelectronics (CADMI) Center, the Research and Productivity Council, and a number of government and institutional research laboratories (the Peat Research Institute, Forestry Research Complex, Department of Fisheries and Oceans Laboratory). Also, a number of Federal and Provincial financial assistance programs provide some support for technology related development and the Province has established a venture capital fund. As the range of programs and efforts have expanded, so have the roles and responsibilities of different key participants in the process. An effective and real partnership is needed between the public, private and research sectors and at the Federal, Provincial and local levels.

Ten priority initiatives are recommended to achieve this strategic thrust (each is discussed in greater detail in Chapter III). These involve the management and coordination of:

- Provincial government science and technology development activities--a recommended technology and economic development branch in the Department of Commerce and Development including a planning division (existing), a science and technology division and a development division.

- Key science and technology initiatives in the Province--a recommended New Brunswick science and technology council with a strong business/industry and economic development orientation, and staff support provided by the Department of Commerce and Development.
- MTC and CADMI--a recommended transition to a consolidated management team for manufacturing technologies;
- Upgraded business assistance services and technologies--a recommended management technology centre to be administered jointly with the manufacturing technology centre;
- The Research and Productivity Council (RPC)--A recommended shift in legal/financial structure to permit pass through of maximum tax benefits and effective competition for Department of Supply and Services, (DSS) contracts while providing assurances to the New Brunswick science and technology community that it is making best use of all public and private institutions in its management of government contracts;
- University and research and development laboratory efforts in technology and economic development--a recommended network of technology transfer/assistance agents at each institution;
- Technology development centres and initiatives--a recommended technology and economic development committee to oversee coordination of major technology development initiatives and subagreements affecting these initiatives;
- Technology assessment, assistance and transfer--a recommended New Brunswick Office of Technology Assessment, Assistance, and Transfer;
- New product and new venture initiatives in the Province--a recommended New Brunswick enterprise and product development corporation;
- A decentralized delivery and outreach system for management and technology support services--a recommended service delivery and outreach role for the industrial commissions in management/technology support targeted to new enterprises and technologies.

Performance and Evaluation Criteria

An important part of New Brunswick's efforts to accomplish the objectives outlined in "Meeting the Challenge of the Eighties" will be through the implementation of its Science and Technology Strategy. A good evaluation and monitoring process will serve to test the effectiveness of the total strategy and its component policies and programs. It will also allow for a more purposeful evolution and updating of the strategy. The evaluation process should be flexible enough to be used both as an analytical tool to estimate program potential on a prospective basis and, on an ongoing basis, to measure the costs and benefits of specific programs. The evaluation process should determine:

a. The cumulative province-wide effect--short, medium and long term--of this set of policies and programs on increasing the number of jobs, worker productivity and the quality of the workforce.

b. The significance of specific programs and their comparative worth--a cost benefit analysis.

Evaluating the cumulative impact of a combined set of policies and programs on the provincial economy will be somewhat more complicated than determining the direct results of individual programs because of the immeasurable effect of other factors such as the ongoing evaluation of Canada's rapidly changing international bases of competition (including technology), foreign government policies (e.g., trade) among others. There is, of course, no real control group against which to measure New Brunswick's achievements. It should also be noted that the criteria used to judge the appropriateness of policy and programs and their effect will necessarily reflects the goals and values of the decisions makers. With this in mind, criteria that can be applied to both overall strategy and individual initiatives are reflected in the following questions:

1. Which policies and programs offer the best prospects for immediate job growth?

2. Which policies and programs contribute the most to long term economic development?

3. Which policies and programs have the highest multiplier effect in terms of total new jobs?

4. Which policies and programs offer the most jobs to disadvantaged workers, i.e., those groups and individuals with past employment problems?

5. Which policies and programs aid in absorption of the seasonally unemployed?

6. Which policies and programs provide jobs with upward mobility opportunities?

7. Which policies and programs best protect the local economy against swings in the business cycle by meeting diversification and counter-cyclical objectives?

8. Which policies and programs best support entrepreneurship and innovation?

9. Which policies and programs help to achieve a reduction in parochialism, fragmentation and duplication?

The results of individual programs and initiatives should be able to be measured so that their relative significance to the economy can be compared, and decisions related to continued funding and programmatic revisions made accordingly. A well designed performance monitoring system will permit frequent checks on the adequacy of the various programs, the degree to which they are on plan, and the efficiency with which they are being run. This in turn will allow alternatives to the plan to increase those activities which have a relatively high payoff and to redesign or eliminate those which do not perform well. In order to be of maximum value, the ongoing monitoring system should provide the following program specific information on a regular and frequent basis:

1. Has the level of awareness and satisfaction with the program been improved among pertinent groups -- various segments of private industry, investors, universities, research institutes, government agencies?

2. What private industry and other actions have been stimulated?

3. What are the results and outputs of those actions in terms of changes in productivity, new products, new or expanded markets, new business formations, new investments in New Brunswick. What are the direct and indirect effect of these changes on employment?

4. How efficiently does the program use resources? What are the program expenditures, revenues and conformance with planning budget.

5. What is the level of support--financial and in-kind-from private industry? Are there commitments to continuing support? What is the possibility of making the program self-financing?

6. How well are established standards, activity levels and milestones being met? To what extent are activities taking place as originally envisioned.

In addition to these broad-based criteria, specific performance measures should also be monitored to determine the direct effects of the initiatives on carefully defined milestones and achievements. The levels of technology development and application should be monitored by indicators such as:

- R&D expenditures by source and use;
- Research capability by technology and industry; and
- Technology assistance and transfer capacity.

Lastly, the perception businesses and the key institutions in the Province should also be monitored as an effective indicator.

In the Chapter that follows, a series of priority initiatives are recommended reflecting this performance framework.

CHAPTER II

PRIORITY PROGRAM INITIATIVES

To implement the strategies outlined in the previous chapter, a series of specific initiatives, actions, and programs are recommended based upon:

- Situation analyses of companies in New Brunswick that have undergone or considered some level of technology application;
- An assessment of the strengths and weaknesses of New Brunswick's economy, technology-related institutions, and resources;
- An assessment of New Brunswick's science and technology resource needs and opportunities;
- A series of panel discussions and interviews with a broad cross-section of groups in New Brunswick--business, government, education, labor;
- A series of strategic workshops with representation from the groups noted above; and
- An understanding of the initiatives that have succeeded and failed in other areas.

Based on these assessments, several cross-cutting themes come quickly to the fore and will be key to the successful implementation of initiatives which are recommended below. Eight of the most important themes are:

1. New Brunswick's population at some 700,000, and its business community are relatively small compared to other Provinces and states. Initiatives must be tailored to reflect the relatively small size of most businesses and the Province's limited resources with respect to both people and funding.

2. Despite its relatively small social and economic base, New Brunswick has a relatively large geographic area over which this base is dispersed. People, businesses, and other resources (i.e., infrastructure, educational, etc.), are unconcentrated relative to other Provinces and states.

3. For the strategy initiatives to be effective and directed to the highest priorities, the private sector must play a significantly stronger role than in the past in science, technology and related economic development policy-making and implementation efforts.

4. Public and private science and technology resources in a number of key areas (engineering, forestry, marine sciences, energy and minerals) are strong and are perceived as such by companies and institutions both inside and outside the Province who are familiar with them. These provide an important base upon which to build.

5. New Brunswick's strong science and technology resources are neither very well linked to each other nor to supporting economic development systems within the Province that could assure their growth and effective utilization in the Province. Fragmentation is a particularly serious problem in a province as small, yet as diverse as New Brunswick.

6. With some exceptions, science and technology resources are currently not as well linked as they could be to other centers of excellence outside of the Province, and some companies view it as easier to go outside rather than through a provincial network. This can represent lost opportunities for building provincial capabilities.

7. Many New Brunswick companies are not familiar with the Province's science and technology resources and perceive them as having an overly academic inclination and as being unresponsive to practical science and technology needs of New Brunswick companies. This perception has severely limited the critical role of business in supporting the development of the Province's resources.

8. Science and technology resources have not enjoyed consistent or stable support from either government or the private sector. Constant uncertainty has diverted energies away from important technology building and development objectives.

These themes have important implications for the Province's ability to more effectively capitalize on science and technology and to achieve the economic development goal of improved job and business opportunities. The priority initiatives that follow are tailored to reflect these themes.

This discussion focuses upon those initiatives that are the highest priority and that require commitment of new or increased levels of resources.

A. SUPPORT SYSTEM FOR INNOVATION, ENTREPRENEURSHIP AND TECHNOLOGY DEVELOPMENT

The goal of this strategic thrust is to strengthen the business support system necessary to create and maintain a climate throughout the Province which encourages entrepreneurship and innovation and stimulates technology development by individuals and within existing companies. This is necessary to ensure that New Brunswick's economy moves progressively and grows to provide continued opportunities in the world economy for New Brunswickers.

As summarized in Figure II-1, six strategic initiatives key to implementing this strategic thrust. They will require new or substantially increased commitment of resources::

A.1 Expanded Technology Assistance Program

As a key component to a strengthened program of business assistance services, technology assistance and outreach will be expanded through this initiative to include better access to upgraded technical information, more responsive and flexible means to conduct technology assessments or audits, expanded industry liaison and affiliate programs with the universities or laboratories and better assistance in licensing and patent work.

The roles and capabilities of technology institutions and resources within the Province must be understood, clarified, and promoted appropriately within the Province. Where gaps exist in technology resources which are priorities for New Brunswick businesses, effective and interactive linkages must be established to external resources. Specifically, the Province must address the following priorities:

- Technical Assistance Delivery System and Network--Many firms have technology needs that can not always be met by local resources or expertise at community colleges or local laboratories, even if the firms are fortunate enough to be near one. At the same time, many in the business community have expressed frustration that government policies often scatter limited technology resources across the Province, diluting rather than concentrating effectiveness at one location. If New Brunswick is to take maximum advantage of its limited resources and meet the varying needs of the business sector distributed over a wide geographic area, a delivery system and network must be established to link the two together. The system must consist of hotlines, referral services, teleconferencing linkages (particularly in addressing geographically dispersed needs), electronic information services and referral directories. The links must extend from the sources of expertise through the business and entrepreneurial assistance networks (noted above) down to the grass roots or community level. The system must

FIGURE II-1

STRATEGY A - INITIATIVES TO STRENGTHEN SUPPORT SYSTEM FOR INNOVATION, ENTREPRENEURSHIP AND TECHNOLOGY DEVELOPMENT

STRENGTHEN THE SUPPORT SYSTEM FOR INNOVATION, ENTREPRENEURSHIP AND TECHNOLOGY DEVELOPMENT

STRATEGIES	PRIORITY INITIATIVES
PROVIDE TECHNICAL ASSISTANCE TO MEET THE NEEDS OF BUSINESS	A.1 EXPANDED TECHNOLOGY ASSISTANCE PROGRAM A.2 UPGRADED MARKETING AND EXPORT ASSISTANCE A.3 UPGRADED BUSINESS, MANAGEMENT, AND PLANNING ASSISTANCE
TARGET FINANCIAL SUPPORT FOR TECHNOLOGY DEVELOPMENT AND APPLICATION	A.4 MATCHING RESEARCH GRANTS A.5 TECHNOLOGY DEMONSTRATION PROGRAMS A.6 START-UP ASSISTANCE AND SEED CAPITAL A.7 EXPANDED VENTURE CAPITAL SUPPORT
CREATE A CLIMATE CONDUCIVE TO ENTREPRENEURSHIP INNOVATION AND TECHNOLOGY APPLICATION	A.8 ENTERPRISE AND PRODUCT DEVELOPMENT SUPPORT A.9 ENTREPRENEURSHIP AWARENESS AND DEVELOPMENT PROGRAM

provide quick responses and also reach out--timeliness is key if the system is to be effective. Among the types of technology resources within and outside New Brunswick to be linked through the system are: RPC, CADMI, MTC, consulting firms, industry research associations, (i.e., the Pulp and Paper Institute of Canada), NRC and other government Research Institutions (i.e., DFO, DNR), private or non-profit institutions (i.e., Atlantic Salmon Research Institute, Woods Hole Oceanographic Institute), and others. Companies have had mixed experiences obtaining technology assistance and research with university research centers. Some found certain departments or individuals to be extremely responsive while others found university specialists to be lacking in practical orientation or interest. The university emphasis in the system should be placed on areas in which the orientation and interest is practical. Comparative technology assistance networks which provide examples upon which New Brunswick can draw include the Ohio Technology Transfer Organization and the Pennsylvania Technical Assistance Program.

- Technical Assistance Broker, Technology Audits and Assessments--Firms throughout New Brunswick have needs ranging from a lack of awareness about new technology and the benefits to a company associated with a technology's application, to the types, "packages" or systems of a particular technology that are most appropriate for a firms needs, to how to install that technology and get it up and running. Sources of such assistance in the past have included vendors, trade shows, trade magazines, conferences, RPC, CADMI, MTC, the IRAP program of NRC consulting firms, among others. Regarding awareness, some firms are unable to afford the time or expense to travel long distances to trade shows, conferences. Local industry associations should consider hosting smaller focused trade shows or seminars in New Brunswick--to bring changing technologies closer to industry. Technology specialists within the Province should be encouraged to be more actively involved in seminars also. Teleconferencing and video taping should be used to disseminate technology awareness information beyond one location--particularly to more remote areas. In addition, where companies are just beginning to consider a particularly new or unproven technology there is often the need for an independent evaluation. A technology audit (by a party without self interest), is one means for providing advice on the most appropriate system to apply, how to package and install it, and how to get it up and running. Some firms in New Brunswick have hired specialized consultants for this advice. Others who cannot afford consultants should be considered for a limited pool of financial grants (targeted to smaller firms discussed below) to obtain such services.

- Industrial Liaison--A more effective interactive channel of access is needed between businesses and universities to service mutual research and technology application needs. The oldest model of such a system in the United States is the Massachusetts Institute of Technology Industrial Liaison Program, founded in 1948. MIT's ILP provides four principal services: quick referral service and network to expertise, to respond to relatively simple questions and provide direct contacts to experts for more complex questions (depending on complexity this may result in a consulting arrangement); regular seminars, symposia, and meetings on current industry and technology topics; and information dissemination and publications (professors spend short leave in member industry or vice versa). Companies take advantage of this by becoming members for an annual fee. In New Brunswick, a liaison program should be considered jointly by UNB and UdeM to provide similar services. Firms expressed a strong interest in more links with universities and a need for more effective access.

- Assistance in Licensing--Licensing is in many instances an effective way to transfer technology. A number of firms have been successful in licensing technologies from foreign companies (who have benefited by entering new markets) or from non-competitive Canadian firms. Japanese firms have been particularly successful in using licensing as a competitive tool to "borrow" the technologies of others. Because of New Brunswick's size and resource limitation, it does not make sense to "reinvent the wheel", but rather license and tailor the technologies of others. The licensing mechanism needs to be emphasized in technology awareness efforts.

A.2 Upgraded Marketing and Export Assistance

Vital to New Brunswick firms, if they are to grow and/or be able to afford technology investments, is the ability to access effectively markets larger than those within the Province. A "chicken and egg" problem, firms must be offering competitive products and services if they are to expand markets successfully. A special problem for some businesses marketing products associated with newer technologies is that the marketing expertise does not exist within New Brunswick, and firms are unable to identify appropriate outside sources for such expertise. Practical, experienced sources of marketing assistance must be identified, "qualified" (again, providing indications of who knows what), and networked. It must be recognized that no one entity can provide all marketing assistance needs, but that firms need to have much more efficient access to sources of specialized marketing expertise. Sources to be built upon within and outside of New Brunswick, include CASE, FBDB, Department of Commerce and Development, Federal Agencies, consulting firms, universities, industry associations, international trade associations, and telecommunications firms (telemarketing). To expand its market beyond New Brunswick, to the Maritimes, the rest of Canada, and even the U.S. and other foreign countries, firms must be prepared to take a giant leap. Special emphases are needed in the evaluation of competitors and market potential, marketing techniques (ranging from telemarketing to participating in trade shows), and export regulations (the latter representing a significant barrier). Many New Brunswick companies have experimented with a variety of "export" methods to overcome these barriers (i.e., joint venturing, licensing, establishing foreign subsidiaries, etc.) and these firms should be asked to share the benefits of "lessons learned" through seminars, profiles or concept papers (which could be prepared by business schools). This information should be disseminated through the overall business assistance network, discussed below.

A.3 Upgraded Business Management and Planning Assistance Program

As the third part of a strengthened system of Business Assistance Services, this initiative will target practical business management and planning assistance services that can support innovation and entrepreneurship both within existing companies and in new companies. This program will also provide a system for accessing practical experience on the management of new technology. Thus it will also target technology application.

A wide range of resources now exist in New Brunswick. A problem faced by many smaller and start-up businesses is that they are unaware of resources for various business assistance that they may require. Many of these firms are led by a single or small corps of individual(s), unable to take the time to track down assistance as a result of more pressing day-to-day concerns and priorities. As a first step, existing business resources must be identified, "qualified" (i.e., what expertise is associated with whom), and selectively improved. Among existing resources are: university and community college business schools (in many cases, these programs and staffs should be expanded and strengthened, with an emphasis placed on New Brunswick business practices and needs rather than classic big business theory and case studies), CASE, the Federal Business Development Bank, industrial development commissioners and chambers, Federal and Provincial government agencies, and accounting and consulting firms. In knitting these resources together, practical problems and real experience must be emphasized. A more effective network must be established from the grass roots to the resource level. Industrial development commissioners should be regularly updated on the changing status of resources. This network must provide access and rapid access and response to questions and problems, and must also undertake outreach efforts to stimulate awareness of business assistance resources. At the grass roots level, industrial development commissioners and chambers should also monitor changing needs, providing feedback to other "resources". A comparable effective network has been established in Indiana. This network links the Chamber organizations at the State, regional (large city), and small town levels using a business assistance "hotline", monitors needs through membership networks; and provides linkages to non-Chamber resources for assistance. At the local level, a "small business enterprise center" concept is being employed in Ohio. It is tailored to individual community needs.

An important ingredient to the viability of particularly smaller New Brunswick businesses is the ability to: set longer term goals, ask themselves the tough questions of "where the business is headed, and how it plans to get there," assess its basis of competition, and determine financial requirements and alternative and innovative sources of assistance. At one extreme, this might involve obtaining the professional services of management consultants. At the other extreme it might involve the simple procedure of asking the right questions of firms--to see if they have considered key factors and if they have planned ahead. This more simple approach could be accomplished through MIT Enterprise Forum types of meetings, by CASE or other advisors. Many firms indicated that if they had access to such advice at key points in their development they would have better anticipated stumbling blocks or requirements for loan or other applications. The rigor through which this is applied must be upgraded in New Brunswick, again emphasizing the nature of local firms as smaller rather than larger or more classical business units.

A.4 Matching Applied Research Grants

In order to encourage more private sector participation in applied research in targeted industry technology areas in the Province, this initiative will permit the Province to provide 50-50 matching grants for needed research efforts which are estimated to also offer significant economic development potential in the Province. These matching grants should be used as "seed incentives". These should be targeted to innovators working in private or public research laboratories, universities, and institutions who have ideas that need to be further developed to a stage at which it can then be determined whether or not demonstration projects or further development is warranted. This initiative would fill needs not currently met by the IRAP and IRDP programs.

A.5 Technology Demonstration Programs

The goal of this action is to demonstrate the benefits of technology application in key industries with multiple participants (be it sawmills or fish processors). This initiative will permit the Province to support special pilot projects as demonstrations which are estimated to have significant benefit in retaining or expanding jobs in support of economic development activities.

This strategy represents a continuation and expansion of the type of activity represented by the Sulfation Roast Leachate (SRL) project being managed by the Research and Productivity Council. Other practical projects should be identified in priorities. There should be a strong indication of Federal/ Provincial commitment to cost share support for prototype development, pilot plants, and demonstration projects. This ongoing commitment will be necessary to provide the encouragement to entrepreneurs and researchers to actively pursue a wider range of ideas than are now being pursued.

A.6 Start-Up Assistance and Seed Capital Program

The rationale for this initiative is discussed in more detail in Appendix A.5, and is highlighted here also. The corporate tax regime governing New Brunswick manufacturing and processing companies engaged in research and development is clearly attractive, particularly if firms are small, Canadian-controlled, and profitable:

- For Canadian-controlled small businesses, federal and provincial corporate income tax rates are 10 and 5 percent respectively; and the tax rates for other manufacturers and processors are 30 percent for the federal government and 14 percent for the Province tax. (The May 23rd federal budget has added a 5 percent surtax on federal income tax for all business excluding small Canadian controlled companies for the period July 6, 1985 to July 1, 1986.)

- Capital cost allowances permit a two-year accelerated depreciation of capital investments; a 100 percent write-off of all research and development expenditures; plus an uplift of 50 percent on the increase in R&D expenditures over the average of the previous three years.

- Investment tax credits are permitted for research and development, ranging from 30 to 50 percent (the latter pertains to areas under the Regional Development Incentives Act) on the total of current and capital R&D expenditures irrespective of any grants received.

In particular, the system of investment tax credits for research and development activity has a major impact on reducing the after-tax cost of an investment and reducing and, most importantly, postponing tax on operating income. With the May 23rd federal budget, small Canadian-controlled companies not in a position to use their R&D tax credits will be able to claim a 100 percent refund from the government on tax credits earned on current expenditures on R&D. Previously, the refundable portion had been limited to 40 percent of tax credits earned on current and capital R&D expenditures. The tax credit for small firms applies to the first $2 million of R&D in a year on which, at that level, the maximum tax credit is $700,000.

Officials of DRIE and the Provincial Department of Commerce and Development have reported on their difficulties in supporting entrepreneurs, innovators, or small companies in financing the product development and start-up phases of new ventures. Through its IRDP-Innovation Program, DRIE allows for grants of up to 50 percent of the cost of the development of new products in Tier 3 and 4 regions (these encompass most of New Brunswick). This has been a vehicle through which it can provide strong support to product development. In the past, however, it has been the larger, well-established companies that have benefited from the IRDP-Innovation programs. NRC's IRAP programs, administered by RPC in the New Brunswick, have had a positive reception by New Brunswick companies, large and small; but the level of financial assistance available through IRAP is relatively low. The SIFAP program of the Province's Department of Commerce and Development has also been popular with small businesses. But it is mainly geared to creating employment through facilitating the expansion of established businesses in the more traditional sectors of the provincial economy. SIFAP also is limited by a relatively low ceiling on eligible financing.

The recommendations presented below should be considered in conjunction with the recommended need for the Venture Capital Support Program (VCSP) and the New Brunswick Enterprise and Product Development Corporation (EPDC), both discussed below. In putting forth these recommendations, we recognize that the federal and provincial agencies involved will need to make sure that any changes to existing programs or new initiatives will be consistent with and complementary to each other, with other financial assistance programs in place, and with the fiscal regime.

The recommendations are:

1. The IRAP (NRC administered) and IRDP-Innovation programs should be reviewed with the objective of finding the means to better support small businesses and entrepreneurs in new product developments, from concept to development and refinement of prototypes. Few new products in New Brunswick have been funded during various stages of development within the Province; instead new products invented within the Province have had to go outside the Province to proceed.

2. The IRDP-Establishment program should be refocused in order to be more responsive to the production start-up requirements of new product ventures, particularly towards entrepreneurs.

3. The SIFAP grant program should be available to new product ventures and supplemented with a new product venture assistance loan program, providing five-year loans of up to $500,000 at the government borrowing rate. (Current programs have lower funding ceilings and are not directed towards start-ups.)

A.7 An Expanded Venture Capital Support Program

We understand that the Province's Venture Capital Support Program (VCSP) is to be reviewed with the objective of increasing its effectiveness in stimulating the formation of private venture capital pools in the Province. (Additional background on this initiative is provided in Appendix A.5.) We recommend that the VCSP should be restructured along the lines of the moderately successful Ontario SBDC program which Alberta, Saskatchewan and British Columbia have subsequently adopted with minor modifications. The success of the Ontario program can be attributed to three factors: the attractiveness to investors of the incentive of a government grant or tax credit equal to 30 percent of the investor's equity investment in a Small Business Development Corporation (SBDC); the need for the SBDC to find suitable investments within a specified time period; and the range of investment opportunities in the Province of Ontario.

The objective of a revised VCSP should be to stimulate the growth of small businesses through the concepts of venture capitalism and government assistance.

The revised VCSP should have the following elements:

1. An investor or group of investors could establish a venture capital fund under the auspices of the VCSP with a minimum of $25,000 in equity capital on registration under the VCSP.

2. Investors would receive a government grant (to individuals) or tax credit (to corporations) equal to 30 percent of their investment.

3. The total equity capital of a VCSP company would be limited to $5 million.

4. A percentage of the equity capital, equal to the government contribution, must be deposited in a trust fund. Approval for withdrawal is given when the VCSP company invests in an eligible small business at which time 3/7ths of the investment can be withdrawn from the trust.

5. The VCSP must purchase new equity shares (voting) to a limit of 49 percent (two or more unassociated VCSP's can own up to 60 percent). VCSP financing of eligible small business should be limited to $2.5 million.

6. By the end of the first year, a VCSP company must have a minimum of $50,000 in equity capital of which 40 percent must be invested by the end of the first year and 70 percent by the end of the second year.

7. An eligible company would be investing in the following areas:

   - Manufacturing or processing
   - Maintenance or servicing
   - Research and development
   - Software development
   - Aquaculture

   and meets these criteria:

   - Canadian-controlled

   - Less than 150 employees

   - Pays more than 75 percent of its wages and salaries in New Brunswick

   - To be eligible, companies must have no linkages to individuals representing public or quasi-public investor groups.

A.8 Expanded Enterprise and Product Development Support

It is proposed that a New Brunswick Enterprise and Product Development Support Initiative or Corporation (EPDC) be established to serve as the focal point for marshalling public, institutional, and private sector resources to support entrepreneurs, innovators, and companies in the development and commercialization of new technologies and products, particularly those oriented to export and to displacement of imports. (The rationale for this initiative is discussed in Appendix A.5.) Overseen by the proposed New Brunswick Science Technology Council (see Chapter III), the EPDC will be given the mandate to:

1. Evaluate new technological innovations and products as to their technical feasibility, merit and economic potential;

2. Advise and guide innovators, entrepreneurs and companies to finding required technical assistance for the further development of their innovation;

3. Advise on technological trends and competing products/technologies;

4. Evaluate the need for expanded venture capital within the Province and advise on the most appropriate approach to address this need.

5. Advise and guide innovators, entrepreneurs and companies on available government financial and technical assistance programs;

6. Advise and guide innovators, entrepreneurs and companies on developing business plans and marketing strategies;

7. Interface with a new New Brunswick Enterprise Forum which will be set-up to provide venture sponsors with advice and guidance on the financing, management and marketing aspects of the proposed business venture;

8. Establish networks with investment groups and financial entities and expose to them new technology investment opportunities, i.e., the matchmaking and deal packaging function; and

9. Identify candidates for the Technology Demonstration Program.

The EPDC will be structured along the lines of the Saskatchewan New Venture Assistance Corporation. It will have a Director at the head, supported by Vice-Presidents of Finance and Marketing. These should be experienced senior-level individuals who have had business experience in the high-tech field. They should be supported by civil servants seconded from the Department of Commerce and Development and DRIE who will provide information on packaging government programs as well as guidance through the government network.

An ad hoc technology advisory group should be set up to assist in the technical evaluation of proposals. Given their knowledge of ongoing research elsewhere and of technological trends they should provide some perspective on the merits of such proposals. This group will also provide recommendations on whether further technical evaluations are required and by whom this is best done. It will be necessary that the EPDC have a budget for such consulting services.

Associated with the EPDC will be a New Brunswick Enterprise Forum, established along the lines of the MIT Enterprise Forum. This forum will be set-up to advise and provide guidance to the innovators and entrepreneurs on the business aspects of the proposed venture. Some 19 such forums exist in North America today. The forum typically involves regular meetings of a rotating panel of advisors (with expertise in venture capital and other finance, industry and technology). At these meetings, innovators/entrepreneurs present their ideas or business plans for critique. Such enterprise forums have made important contributions to the successful start-up of new ventures in other jurisdictions. The New Brunswick business community should be asked to make a similar contribution of their time and experience.

Care must be taken that the EPDC present an arms-length, objective evaluation of any new product venture, carefully qualifying any technical or business concerns and noting where the project might be at risk.

To give technology-related entrepreneurs and innovators a "boost" during their earliest development period, New Brunswick needs to strengthen its policy to offering innovators lower-than-market-rate lease or rental rates for building space. While some provinces and states have established a single "incubation center". New Brunswick needs to pursue a more broadly defined concept of innovation centers. This is because of its scale and the geographic dispersion of needs relative to resources. In effect, the Province already has the necessary tools. Vacant buildings have been bought by the Province and rented at nominal fees to small and start-up businesses for a number of years. As this effort is strengthened--existing vacant space at schools and universities could be made available, also. It will be important to establish and enforce strict guidelines for applicants. Lease periods should be limited to two or three years. Incubator leases should be extended to only those in the early growth or incubation stage. Such "centers" should include:

- Access at fair cost to meaningful shared services;
- Access to university or community college environments to encourage elbow rubbing with technical and business expertise;
- A technical director to act as a ombudsman and resource to companies/entrepreneurs.

Successful models which the New Brunswick initiative can draw upon include Rensselaer Polytechnic Institute in New York, and private incubation centers being developed in Pennsylvania and Ohio. The latter are developing multi-tenant incubation centers. These centers provide a technical director who can provide advice to firms, access to venture capital, and shared secretarial and other support services in exchange for an equity position in the firm.

A.9 Entrepreneurial Awareness and Development Programs

To place an emphasis on entrepreneurship, individuals must be enlightened to both the opportunities and tough challenges associated with actively pursuing a new idea or project. In other areas, an effective stimulant has been to observe the successes and experiences of others. New Brunswick has a cadre of such examples, among them PTL, Universal Systems, Ltd., Mynic, Datamaster, and McCain's, some years ago. With their permission, profiles of their experiences should be introduced as part of an entrepreneurship curriculum as part of the standard program and continuing education at New Brunswick's business schools. Added to these should be comparative case studies of experiences used as recognized entrepreneurial development programs such as Carnegie Mellon University, Pittsburgh, and Wharton Business School, Philadelphia. The emphasis here is on today's small businesses, rather than case studies of today's large multinationals who were yesterday's entrepreneurs. In addition, practical seminars on key relevant topics including venture capital, innovative financing, managing rapid growth, expanding markets, among others should be offered on a regular basis at local chambers and by industrial development commissions.

Seminar speakers should have a practical, experienced-based orientation. An "entrepreneurs club" can provide a network for mutual support, recognition among entrepreneurs and linkages to "entrepreneur's clubs" in other areas. In addition, a regular forum analogous to the MIT Enterprise Forum should be established. On this forum, a group of experienced entrepreneurs, venture capitalists, and executives of larger business can regularly meet to critique the proposals of and offer guidance to innovators and entrepreneurs.

B. SUPPORT THE DEVELOPMENT OF TECHNOLOGY-BASED INDUSTRIES IN THE PROVINCE

The objective of this strategy is to target technology-based industries as a priority in New Brunswick's economic development policies and programs, particularly those directed to stimulating inward investment and growth of the service sector. This will provide an effective means for bringing external technology expertise into the Province and for expanding technology development opportunities beyond manufacturing applications. A first priority initiative will require increased commitment of resources to achieve this objective, and two additional priority initiatives will require special emphasis through the course of executing economic development strategies. As shown in Figure II-2, these are:

B.1 Expanded Service Sector Eligibility in Support Programs

The service sector has an important role to play in future development opportunities in New Brunswick. Yet it has been excluded from eligibility for various types of financial and other assistance. To support this sector, this initiative will broaden the eligibility requirements of key business and industry support programs to include selected segments of the service industry (e.g., software development, engineering consultants). These selected segments must meet criteria--for job creation and export promotion--which assure their economic development as a leading industry.

B.2 Procurement/Offset Policies Targeted to Build Technology-Based Industry

Both Federal and Provincial procurement policies should be used as a mechanism of leverage in building an expanded technology-based economy within New Brunswick. These policies apply to military and non-military procurements by the government and are being applied by the New Brunswick Department of Commerce and Development and DRIE. The implementation of these policies should be directly linked to the Science and Technology Strategy and should be executed with a targeted emphasis on technology development and transfer opportunities.

FIGURE II-2

STRATEGY B - INITIATIVES TO SUPPORT TECHNOLOGY-BASED INDUSTRIES

STRATEGY	PRIORITY INITIATIVES
SUPPORT THE DEVELOPMENT OF TECHNOLOGY-BASED INDUSTRIES IN THE PROVINCE	B.1 EXPAND SERVICE SECTOR ELIGIBILITY IN SUPPORT PROGRAMS B.2 TARGET PROCUREMENT/OFFSET POLICIES TO BUILD TECHNOLOGY-BASED INDUSTRY B.3 TARGET EXTERNAL MARKETING EFFORTS TO ATTRACT TECHNOLOGY-BASED INDUSTRIES

B.3 External Marketing Efforts Targeted to Technology-Based Industry

In a manner similar to initiative B.2, ongoing external economic development marketing efforts by the Department of Commerce and Development and DRIE should be directly linked to the Science and Technology Strategy and should be executed with a targeted emphasis on technology development and transfer opportunities.

C. STRENGTHENED ENGINEERING, MANUFACTURING, AND MANAGEMENT TECHNOLOGY RESOURCES

The goal of this strategic thrust is to upgrade and provide strengthened linkages between New Brunswick's engineering, manufacturing, and management technology resources and institutions. This intends to promote more efficient utilization of technologies in manufacturing, enhance the competitiveness of New Brunswick firms, and stimulate diversification opportunities. Specifically, this strategic thrust should strengthen four functional activities: education; training; technology and technical assistance; and technology transfer. To achieve this objective, a strong participation by the private sector will be required.

The rationale and background associated with this initiative are discussed in more detail in Appendix A.4. As summarized in Figure II-3, five priority initiatives will require increased commitment of resources to achieve this strategic objective:

C.1 Manufacturing and Management Technologies Council

An overriding priority associated with the engineering, manufacturing and management technology initiatives is to address the need for an umbrella leadership group to provide strong direction, and ensure effective management of and coordination among initiatives. An initial action, then, is to establish a Manufacturing and Management Technologies Council, or similar leadership and oversight group. This council should be headed by a single board of directors; in effect, this board should be drawn from the two existing boards of CADMI and MTC. The private sector should hold a majority of seats on the Board. The Board should also have representation from business schools in the Province. The role of the Board should be to provide overall direction and oversight of the activities described below to ensure that they address the most promising opportunities and priority needs--including specific basic research projects--in an effective manner. This Board, with its clout, should marshall the involvement and contributions of other institutions and businesses throughout New Brunswick, as appropriate. Reporting to the Board, should be an executive director. This person should be appointed to carry out Board decisions, coordinate the various activities described below, and ensure effective management of the resources and facilities. The executive director should work closely with representatives of the New Brunswick chapter of the Canadian Manufacturers Association and other

FIGURE II-3

STRATEGY C - MANUFACTURING AND MANAGEMENT TECHNOLOGIES INITIATIVES

STRENGTHEN ENGINEERING, MANUFACTURING AND MANAGEMENT TECHNOLOGY RESOURCES

STRATEGIES

- ESTABLISH A MANUFACTURING AND MANAGEMENT TECHNOLOGY COUNCIL
- STRENGTHEN MANUFACTURING TECHNOLOGIES CENTRES
- STRENGTHEN CENTRES FOR APPLICATION AND DEVELOPMENT OF MICROELECTRONICS
- ESTABLISH A NEW INITIATIVE IN MANAGEMENT INFORMATION SYSTEMS AND TECHNOLOGIES
- ESTABLISH A NEW INITIATIVE IN SYSTEMS ENGINEERING AND INTEGRATION

PRIORITY INITIATIVES

(SEE APPENDIX A.1)

key industry groups to promote the resources and services of these initiatives and to monitor progress. The executive director should be supported by one or two staff persons--overall a lean operation rather than a new "agency." This umbrella group should coordinate and oversee four priority activities (outlined below), each designed to interact directly with and serve the needs of the private sector.

C.2 Manufacturing Technology Centre

Building on existing facilities, expertise, and recent accomplishments, MTC should continue to pursue private sector support and joint projects/activities in training, technical assistance and prototype development. RPC, with its technology transfer mandate, should play a strong role in delivering the assistance and transfer services. Funding for MTC should be increasingly provided by the private sector, through contracting of services and levying user fees to companies seeking to use MTC facilities or staff. Efforts should be made to improve the overall efficient utilization and management of MTC facilities to address the concern that some MTC facilities are "overbooked" while others are underutilized. Local MTC staff should undertake promotional efforts to reach out in their communities both to generate awareness among local business and to ensure that their activities are tailored to local needs. Some are already doing so, working with Industrial Development Commissioners.

C.3 Centre for Applications and Development of Microelectronics

CADMI should continue to build upon its expertise and resources, and should sharpen its focus in providing technical assistance to firms applying microelectronics technology. CADMI staff should be dedicated full-time to this objective, and should undertake increased efforts to promote their resources. As with MTC, this has begun to occur in some instances with the assistance of the industrial development commissioners. The Council or Board of Directors (noted above) should provide strong direction on the evolution of CADMI's activities. In addition, the activities must be sufficiently attractive to elicit the private sector support that will be necessary for CADMI to become self sufficient at the end of its five-year mandate from DRIE.

C.4 Management Information Systems and Management Technologies

A new initiative should be undertaken to provide access to strengthened management technologies, management information systems (MIS), data base management, and related services for manufacturing and other firms in New Brunswick. Management technologies are increasingly important for companies in assessing and upgrading their competitive position. The Business Schools at UNB and at other institutions should upgrade and expand their programs to provide businesses better access to strategic management and technology management expertise and courses. The MIS services under this initiative should be in the form of a joint venture by private firms with MIS expertise who will provide these services on a contract or fee basis. Among the firms and groups which might be involved are New Brunswick Telephone (with extensive communications and MIS capability); and specialty consulting firms and individual consultants, for example, from UNB's Computer Sciences Department. Among the services which could be provided are systems packaging, training, installation of turn-key systems, needs analysis, and general technical assistance. This effort should be overseen by the MMTC board and should be coordinated with the Management Services Division of the Department of Commerce and Development.

C.5 Systems Engineering and Integration

A new initiative should be undertaken in systems engineering and integration. This also should be in the form of a joint venture by interested private engineering consulting firms and individuals, including engineering professors. Systems services should be provided on a fee basis, and could include process systems packaging; integration systems linking MIS with process, production, quality control; and other functions, such as needs analysis. Means of linking this initiative with the engineering systems capability of NRC should be explored.

D. UPGRADE NETWORK OF STRATEGIC SCIENCE AND TECHNOLOGY RESOURCES

The goal of this strategic thrust is to develop and upgrade a network of strategic science and technology resources targeted to broad-based technology and economic development opportunities. Three priority opportunity areas have been targeted at this time, and initiatives associated with each are outlined below and summarized in Figure II-4. For New Brunswick's future, it will be important to continue to scan the science and technology horizon for emerging opportunities with potential relevance for New Brunswick. To identify these opportunities, a fourth initiative is recommended.

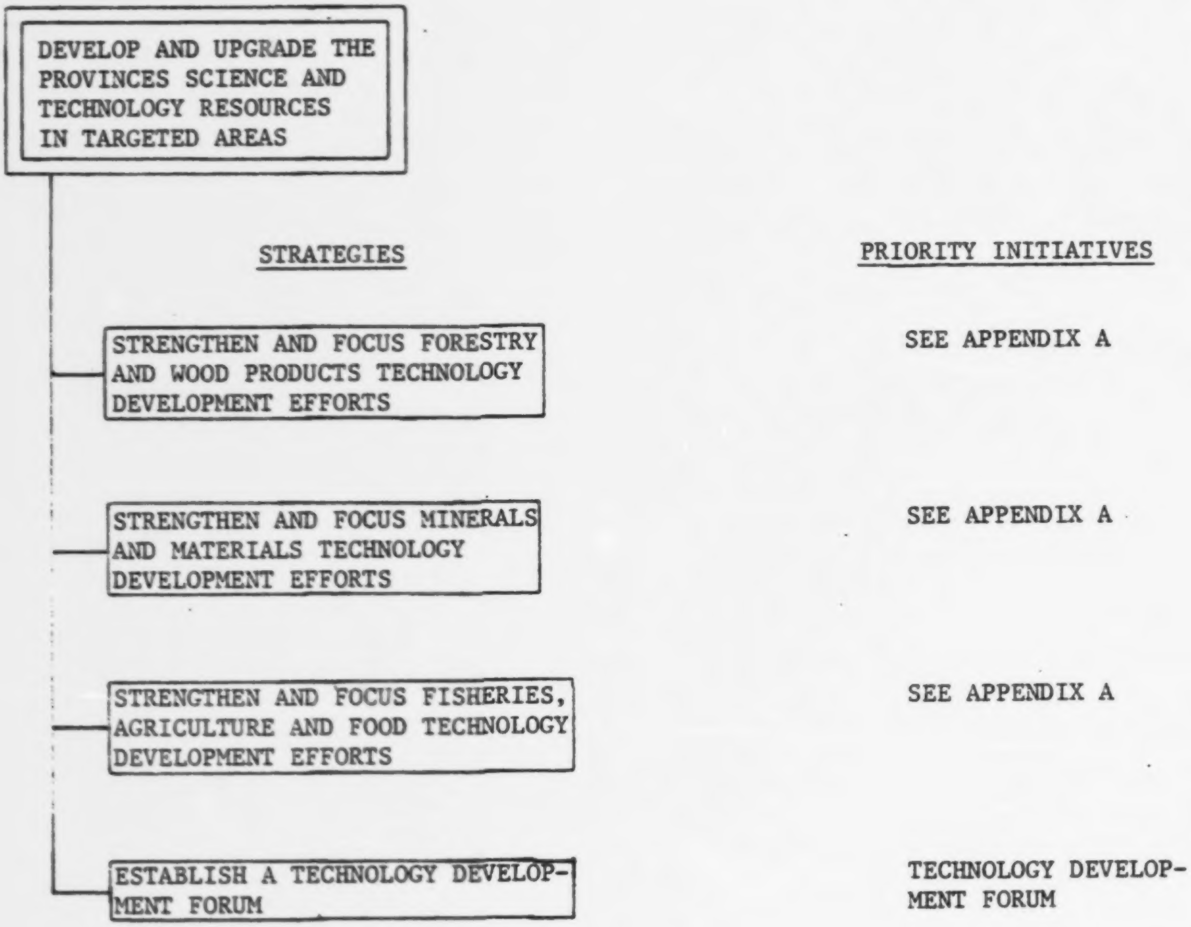
D.1 Forestry and Wood Products Technology Development

Forestry and wood products technologies represent a priority for New Brunswick, as discussed in detail in Appendix A.1. The Maritime Forestry Centre Corporation represents the logical umbrella organization through which initiatives can be pursued. Simultaneously, two first steps are necessary:

- Marshall Private Sector Participation and Support. Aggressive outreach efforts are needed to attract the participation and involvement of private sector interests in New Brunswick. Among the collective interests to be targeted are the New Brunswick Forest Products Association, the Maritime Lumber Bureau, the Association of Forest Engineers, the Association of Professional Engineers, and others. The

FIGURE II-4

STRATEGY D - TECHNOLOGY RESOURCE INITIATIVES


DEVELOP AND UPGRADE THE PROVINCES SCIENCE AND TECHNOLOGY RESOURCES IN TARGETED AREAS
STRATEGIES
PRIORITY INITIATIVES
STRENGTHEN AND FOCUS FORESTRY AND WOOD PRODUCTS TECHNOLOGY DEVELOPMENT EFFORTS
SEE APPENDIX A
STRENGTHEN AND FOCUS MINERALS AND MATERIALS TECHNOLOGY DEVELOPMENT EFFORTS
SEE APPENDIX A
STRENGTHEN AND FOCUS FISHERIES, AGRICULTURE AND FOOD TECHNOLOGY DEVELOPMENT EFFORTS
SEE APPENDIX A
ESTABLISH A TECHNOLOGY DEVELOPMENT FORUM
TECHNOLOGY DEVELOPMENT FORUM

key companies who represent the "movers and shakers" in the forestry sector should be targeted individually and asked for their views and interest in the Centre, and their own needs in terms of desirable functions the Centre might provide.

- Long-Term Strategic Plan for the Hugh John Fleming Forestry Centre. A strategic plan for the Centre should be developed and implemented. We recommend that a Task Force be assigned to this task. It should draw a majority of its representation from the private sector and include the directors of the participating research institutions.

The strategic plan should identify priority directions, functions and implementation procedures for the Centre. Among the priorities which should be considered for inclusion are the following:

- Organizational Structure. The Board of Directors should draw more than half its representation from the private sector as well as representation from each of the affiliated agencies. The Centre should be managed by a senior level Executive Director supported by a small core team. The Executive Director will need to be given the mandate and resources to implement the strategic plan. In addition, the Executive Director should provide for effective coordination of available resources and the activities of affiliated and other institutions.

- Joint Private-Institutional Research Efforts. The Centre should establish the ways and means necessary to attract and facilitate private sector sponsorship and/or participation in research efforts at the Centre. At present, the Centre anticipates having physical space which could be utilized by the private sector in joint research endeavors. These endeavors can be pursued on an individual or collaborative basis by companies with researchers affiliated with the Centre. An example of such a mechanism is the Microelectronics Center of North Carolina. In this case, the capital cost of offices, laboratories and other facilities was funded by the state and companies' participants were targeted as "members". Company "membership" requires fees to support operating and program costs. In addition, university professors are affiliated with the Centre to pursue research projects. Participating companies can assign their own staff to the Centre and pay annual fees to cover operating expenses and individual research projects. Research is conducted jointly or individually.

Other mechanisms can be considered which would involve charging fees or lease rates to recover a portion of the capital cost invested in the Forestry Centre, and to cover operations costs and consulting arrangements with individual researchers. Research programs should reflect industry needs and be chosen after consultation with the private sector. This will be important to providing the Centre with a market focus and a means to attract private sector participation.

- Forestry Management Technologies and Instrumentation. This is an existing strength of New Brunswick forestry institutions and should be maintained and highlighted as a focus of expertise within the Centre. A stronger environment and a focal point of supporting resources are needed for innovations such as measurement instrumentation, and remote sensing mapping devices and techniques. The strength of UNB's Faculty of Forestry provides the potential to spawn similar innovations which might have market potential beyond the borders of New Brunswick or even the Maritimes. Within the Centre, there should also be a capability to monitor worldwide competing and complimentary technologies; and to provide a point of contact for innovators and entrepreneurs to other supporting business, financial, and technical assistance services.

- Forestry Silviculture and Biotechnology. The Centre should carefully consider the extent to which its affiliated institutions are in a strong enough position to aggressively pursue biotechnology applications to silviculture. This very young technology offers significant promise for silviculture practices and has been referenced in the 1984 Federal-Provincial Subsidiary Agreement on Forestry Resources. This should be leveraged to pursue a research program at the level necessary to maximize New Brunswick's competitive strengths in silviculture research. The budworm and other disease control research provides New Brunswick with a potentially competitive edge in forestry-related biotechnology, and compliments work underway at RPC.

- Extension service. A comprehensive extension service should be established within the Centre and pursued in a fashion similar to the U.S. forestry and agricultural extension programs. This service initially should include two or three staff, with at least one drawn from Forintek (therefore with direct linkages to Forintek's expertise) and funded by the Centre (Province). The extension service staff should maintain a very visible field presence. They should reach out to forestry businesses regularly, and secure the trust and confidence of those businesses as a reliable and qualified first contact to assist directly or access appropriate assistance in a variety of technical needs. An important aspect of this service will be quick and timely response to businesses questions or requests for assistance. In addition, the service should be the focal point for a forestry technology information service. The State University of New York forestry extension service is a good example of the type of service that should be provided. Among the areas of assistance which should be directly provided by the extension service staff in New Brunswick are:

- Saw mill technologies, including technical assistance in making saw mill operators aware of the technologies and, more importantly, potential benefits associated with application. This might also include a "saw mill improvement program," such as provided by the U.S. Forest Service, to conduct free technology and operational audits of individual saw mills and to recommend improvements.
- Wood products-related, to assist saw mill and other forestry-related businesses in considering the potential for and needs associated with wood products development opportunities. This will be important in assisting saw mill operators to become less dependent on the commodity market.
- Marketing and export, to assist forestry related business in more adequately considering new markets for their products and services. Overall, it will be important that the extension service staff and Centre maintain adequate linkages to sources of marketing and export expertise outside the Centre and Province. This should insure that sound advice is readily available.

D.2 Mineral and Material Technology Development

Minerals-related technologies represent a priority for New Brunswick, as discussed in detail in Appendix A.2. A Task Force should be set up to define a new Mineral Technology Development Initiative. This Task Force would become the focal point for marshalling public and private sector science and technology resources to support and encourage mineral resource development and processing in the Province. Ideally, this initiative would involve the leading companies in the New Brunswick mining sector; the New Brunswick Electric Power Commission, the New Brunswick Research and Productivity Council and Energy Mine, and Resources (EMR). In addition, this initiative will be structured in a way that allows the participation of the universities and other private research groups on a full or selective basis. The above entities should be represented on the Task Force. We envisage that this new initiative would initially build upon the research programs of the RPC Mineral Development and Processing Department; including the SRL Pilot Plant program, and the New Brunswick Power/EMR demonstration circulating fluidized bed technology for burning coal/oil shale mixtures. Longer term, we would hope to involve public-private sector research and demonstration projects, for example in non-destructive testing and electrochemistry.

If the Task Force determines that it is possible and desirable to recommend establishment of a new Centre, possibly along the lines initially proposed by RPC in 1983, we would recommend the following mandate:

(i) To work with New Brunswick industry to develop or adapt new process technologies to the New Brunswick situation;

(ii) To test and evaluate existing and new technologies best suited to advancing technological growth in the region;

(iii) To assist in the transfer of technology to industry; and from bench scale research through pilot demonstration in select technologies;

(iv) To further develop research capabilities and expertise on problems related to a) metal and by-product recoveries from complex base metal deposits, b) co-combusting of oil shale and high-sulphur coals;

(v) To upgrade bench scale R&D capabilities in technologies related to using Provincial resources in chemical production;

(vi) To involve New Brunswick companies to the maximum extent possible in the Centre's research program, including joint venture research, access to facilities for the testing of proprietary technology, etc.;

(vii) To attain self-financing through contract research and fees for use of facilities within five years.

The Board of Directors of the Centre should include representatives of the mining industry, engineering consulting community, the universities and RPC. RPC would be well-positioned to manage any such new initiative, although consideration should be given to setting up a separate core management group.

Involvement of the mining sector is critical to the success of any initiative in this area. Consequently it is important that the Task Force ascertain the research needs and priorities of New Brunswick mining companies to determine the new or existing research programs they are willing to support. Private companies should also be pressed to identify possible joint venture research programs.

D.3 Fisheries, Food and Aquaculture Technology

A Maritime Fisheries and Aquaculture Initiative would be the initial effort associated with development priorities in food, aquaculture, and fisheries related technologies. This initiative described in more detail in Appendix A.3, would be the basis for an immediate effort to support, coordinate, and focus finfish technology capabilities at St. Andrews and shellfish technology capabilities on the east coast. Both of these would be supported by an upgraded food technology capability at UdeM and RPC (at UNB).

The objective of New Brunswick's aquaculture and marine sciences initiative is to promote cold water species aquaculture development (salmon, trout and other species), to promote shellfish farming opportunities, (particularly mussels and, longer term, lobster), to promote extension of these activities to New Brunswick regions supporting more traditional fishing activities, to provide a framework for promotion of longer term aquaculture opportunities related to other species (e.g., scallops, turbot and other species), and to continue to promote diversification of traditional fisheries and value-added production. To accomplish this, a strong combined, and effectively coordinated effort is required by both the public and private sector, with substantially increased participation by the private sector to provide a realistic market perspective.

The New Brunswick aquaculture and marine science community should pursue a series of actions to capitalize on its unique natural resource and concentration of specialized research expertise. It should take advantage of the existing resources committed by the existing Canada-New Brunswick Fisheries Development subsidiary agreement and the strong development climate promoted by the Science Council of Canada Statement on Aquaculture. A first priority will be to establish:

- Aquaculture and Fisheries Development Council. If New Brunswick is to effectively compete in the rapidly growing and increasingly competitive aquaculture and fisheries industry a critical void which must be filled relates to leadership. While there are numerous public and private "players" apparently dedicated to a common goal, there is the need for a single leadership voice to set priority directions, marshall and coordinate resources, and insure commitment and follow-through. This "council," or some similarly titled group, should have a governing board with a majority of representatives from the private sector (including participating larger firms, entrepreneurial seafarmers, and private, non-profit research institutes) and from the key public research institutes and agencies. Representation should be distinct and equal from the Bay of Fundy region (representing largely salmonid opportunities) and East Coast (representing largely shellfish opportunities). This council should not take the form of another "agency." Rather it should be vested with decision-making authority to allocate a portion of the public funds dedicated to aquaculture and fisheries development and to set priorities for jointly funded private-public research and demonstration projects. The Council should have a lean staff: an executive director, or two co-directors (with the combined characteristics of experience in the field, wisdom, clout, an ability to command respect within the fisheries and aquaculture community, and the drive to "make things happen"), and one or two support staff. Each represented agency, institute and business should contribute the limited operating budget of the council.

On the near-term agenda of this leadership council are the following steps to clearly delineate, reinforce and promote its competitive edge in coldwater specie and shellfish aquaculture:

- Maintain and Expand as necessary Basic and Applied Research Budgets. If New Brunswick's research institutes are to maintain and strengthen their "edge" to pursue aquaculture development, funding for basic and applied research programs must be maintained with a focus on the technologies most important to New Brunswick's future opportunities. Specifically, the recent trend of declining funding commitment to aquaculture related research at the DFO Biological Station must be reversed. Building on the station's remaining expertise and on the fact that 90 percent of continuing direct research on aquaculture in New Brunswick comes out of DFO St. Andrews, this must be revitalized to become a leading research institution. Overall, R&D commitments must insure that aquaculture and related technologies "work" better, and that basic research is continued at a level of support necessary to spawn new innovations.

- Develop a Smolt Resource Advantage. To establish this edge over the rapidly growing European salmon and trout farmers, the New Brunswick aquaculture community must insure that the quality and supply of smolt production is developed within the Province. A proper supply must be developed by encouraging the building of a series of hatcheries to: a) promote efficiency through competition, and b) reduce dependency of supply on one source which may be vulnerable to disease, limited water supply, and other factors. Private sector endeavors must be aggressively supported in this regard, including Sea Farm's activities and other potential private contract arrangements to manage smolt enhancement programs.

- Maintain and Strengthen Linkages to Aquaculture Research Expertise outside New Brunswick. This effort is vital to monitoring research and aquaculture technology development, both to effectively capitalize on them for the New Brunswick community and to keep track of the changing competitive environment. New Brunswick's limited resources require that, where appropriate, existing technology developed by "outsiders" be targeted and adapted to the needs of New Brunswick's community. An important example is in the engineering aspects of aquaculture, where the NRC's and other facilities in Halifax have a noted strength. In other instances, this monitoring activity should provide important signals to the research community and aquaculture industry in New Brunswick regarding both its competitive position and where steps may be required to strengthen it.

- Joint Demonstration Projects. The leadership council should continually consider potential research projects, the application of which provide common benefit to the New Brunswick aquaculture community. These joint projects should be pursued on the basis of matching funding by the private and public sector. A mechanism for private sector input should be considered which scales contributions relative to the size measure by sales, employment or some other indicators of private participants. Thus, entrepreneurs who would benefit from the research would take a "share" of the funding responsibility, but smaller relative to larger participants. One suggested demonstration or joint research project is in the area of health and disease control. Another might be in caging. In this or other areas, a project proposal should be assembled to identify a program of work, anticipated results, participants, cost and timing. This should be reviewed for approval by the leadership council.

- Marine Science and Aquaculture Extension Service. Building upon the current activities of the research institutions in St. Andrews, along the East Coast, and elsewhere in the Province and on the proposed "extension activities" associated with HML's Aquaculture Center, a high profile extension service should be established. An overall mandate of this service will be to facilitate transfer of technology from research institutions to businesses and transfer opportunities to the more traditional fishing industries, particularly along the East Coast. (In Norway, half of today's salmon farmers were at one time former fisherman or fish processing employees in New Brunswick, this could also have important implications.) The service should be modeled in a fashion similar to the agricultural extension services. It should be decentralized and operate out of the New Brunswick Department of Fisheries' regional offices. It should draw its staff from HML, DFO, NRC, ASRI, and other institutions and be funded by government. The extension service staff should maintain a very visible field presence in the Bay of Fundy and East Coast regions. The service staff should actively reach out to aquaculture and fisheries businesses regularly, securing their trust and confidence as a reliable and qualified first contact to assist directly or access appropriate assistance for a variety of technical needs. An important aspect of this service will be quick and timely response to questions or requests for assistance by businesses. Among the areas of assistance in which the marine science and aquaculture extension service should specialize are:

- Direct technical assistance, to facilitate transfer of technology, expertise, and practical application between aquaculture and marine science research institutes and businesses.

- Information clearing house, to provide improved access for businesses to information on relevant research, technical issues, and supporting information (e.g., market trends, transportation and shipping methods, etc.).

- Marketing and export assistance, to assist fish and shellfish farmers and related businesses in more adequately considering new markets for their products and services. Already the Norwegians are shipping farmed salmon by air freight to markets beyond the European community--among them New England, the state of Washington, and Tokyo. This assistance will be vital if the New Brunswick industry is to have a chance at cracking Norway's dominant market share--currently set at around 85 percent of farmed salmon, with Scotland holding on to the Number 2 position. To be effective, the extension service must be capable of both providing some level of marketing and export assistance itself, and also of drawing upon outside expertise, as necessary.

- Referral assistance to sources of financial support. Working closely with the industrial development commissioners and the Department of Commerce and Development, extension service staff should provide quick referral to appropriate sources of public and private finance, and should provide access to the necessary technical and financial expertise to expedite evaluation and approval of requests for financial assistance. This is particularly important to this very young industry with which many financial institutions have little familiarity.

- Legal and Regulatory Guidelines. As noted above, a priority need to ensure the orderly development of cultured fisheries opportunities relates to the establishment of regulatory controls, standards, and other legal guidelines. At present, the New Brunswick aquaculture community is without "rules and guidelines" of its own. Yet it is competing with an industry in Nova Scotia and elsewhere in which appropriate guidelines have been adopted. The leadership council should assume responsibility for drafting proposed regulations and legislation for aquaculture, drawing upon Nova Scotia's experience, and national and international experience, and commissioning necessary level and technical support. The proposed legislation should be put forth to the appropriate Provincial bodies for review and approval. To ensure swift action, the leadership council may have to undertake a campaign to enlist broad support across the Province. It should be prepared to do so.

D.4 Technology Development Forum

An annual forum should be held with representatives of the New Brunswick Science and Technology Council, the private sector, government, universities, the National Research Council, colleges, labour, research laboratories, and others with an interest in science and technology. The objectives of this forum is to scan the horizon for emerging science and technology opportunities (e.g., remote sensing and microwave technology), to screen these in terms of their relevance for New Brunswick, and to identify and agree upon special initiatives, such as those outlined above, which will be required for New Brunswick to capitalize on these opportunities.

CHAPTER III

PRIORITY MANAGEMENT INITIATIVES

To implement the five strategies and twenty-two priority program initiatives outlined in the previous two chapters, ten management implementation initiatives have been recommended based upon:

- An assessment of the strengths and weaknesses of New Brunswick's existing institutions and management resources

- An assessment of lessons learned from previous New Brunswick initiatives in science and technology and economic development

- An assessment of lessons learned from other science and technology initiatives which have been implemented elsewhere

- An understanding of the critical need for on-going commitment, coordination and leadership of science and technology related initiatives

- An understanding of the organizational changes and government reform initiatives taking place at the Federal and Provincial levels

- An understanding of the critical need and challenge for effective public/private partnerships in this area

Based on these assessments, nine key conclusions provide the foundation for the ten management implementation initiatives recommended in this Chapter:

1. Technology Development Capabilities need to be centralized as much as possible in order to assure a sufficient critical mass; but delivery capabilities need to be decentralized geographically and sectorally given the geographic and economic diversity of the Province.

2. Technology resources are currently fragmented and need to be effectively networked both from within and outside the Province if development opportunities are to be efficiently pursued.

3. Science and Technology initiatives generally need to be driven and led by industrial development initiatives. Management structures need to reflect this relationship so that science and technology initiatives have a strong direction and economic development thrust.

4. Science and Technology activities in general are too fragmented, isolated and government dominated. Strong leadership and private/public partnerships will be needed to take better advantages of existing resources and opportunities.

5. Research and Development expenditures are relatively limited in the Province. While they need to be increased, substantial increases in government expenditures are not likely. Thus, expenditures need to be much more effectively leveraged and applied.

6. Engineering technologies are very strong and relatively concentrated in the Province. However, they tend not to be well linked with other science and management capabilities. Thus, they need to be better utilized in the broad range of technology development initiatives.

7. Management and marketing technology resources are relatively weak and fragmented in the Province. Since it is these management and marketing technologies which increasingly affect the basis of competition for manufacturing and export businesses in the Province, they need to be significantly upgraded and integrated with other technology development initiatives.

8. Natural resource development technologies are relatively strong, but often fragmented in the Province and the Maritimes. Since it is in these areas that the Province enjoys some of its greatest strengths, they need to be better coordinated and applied in the Province.

9. As noted earlier, the Province is relatively small and has very limited financial and management resources. Consequently, management structures need to be very streamlined and closely coordinated.

Figure III-1 provides an overview of the ten recommended management initiatives in relation to the overall strategy of improving the management of science and technology resources in New Brunswick.

The first three initiatives are recommended to demonstrate and effectuate a strong and sustained commitment of federal/provincial and public/private partnerships in the management and implementation of science and technology strategy in New Brunswick. They are also recommended to maximize the leverage of limited public and private resources and to assure effective coordination of a wide variety of existing and proposed activities. In summary:

- E.1 The Federal/Provincial Management Committee for Science and Technology (FPMC) will have the responsibility not only for management of the proposed Canada/New Brunswick subsidiary agreement on Industrial Innovation and Technology

FIGURE III-1

STRATEGY E - MANAGEMENT INITIATIVES

IMPROVE THE COORDINATION, LEVERAGE AND TARGETTING OF SCIENCE AND TECHNOLOGY RESOURCES AND STRENGTHEN THE PARTNERSHIP COMMITMENT TO THE MANAGEMENT OF THE SCIENCE AND TECHNOLOGY STRATEGY

STRATEGIES	PRIORITY INITIATIVES
ASSURE EFFECTIVE COORDINATION, LEVERAGE, AND COMMITMENT OF FEDERAL/PROVINCIAL AND PUBLIC/PRIVATE PARTNERSHIPS IN SCIENCE & TECHNOLOGY	E.1 BROAD-BASED FEDERAL/PROVINCIAL MANAGEMENT COMMITTEE E.2 NEW BRUNSWICK SCIENCE AND TECHNOLOGY COUNCIL E.3 TECHNOLOGY & ECONOMIC DEVELOPMENT BRANCH OF COMMERCE & DEVELOPMENT
PROVIDE FOR CLEAR FOCUSING OF RESOURCES AND CAPABILITIES ON ENTREPRENEURSHIP, INNOVATION, TECHNOLOGY ASSISTANCE AND TRANSFER, AND KEY INDUSTRY/TECHNOLOGY TARGETS	E.4 RPC CONTRACT OFFICE OF TECHNOLOGY ASSESSMENT, ASSISTANCE AND TRANSFER E.5 CONTRACT ENTERPRISE AND PRODUCT DEVELOPMENT SUPPORT OFFICE E.6 MANUFACTURING AND MANAGEMENT TECHNOLOGY CENTRES E.7 INDUSTRY/TECHNOLOGY DEVELOPMENT TASK FORCES OR COUNCILS
IMPROVE THE DECENTRALIZED DELIVERY SYSTEM FOR SCIENCE AND TECHNOLOGY RESOURCES	E.8 NETWORK OF DESIGNATED UNIVERSITY/LABORATORY TECHNOLOGY TRANSFER AGENTS E.9 INDUSTRIAL DEVELOPMENT COMMISSIONS AND DECENTRALIZED DELIVERY/OUTREACH E.10 MORE FLEXIBLE STRUCTURE FOR THE RESEARCH AND PRODUCTIVITY COUNCIL

Development but also for a leading management role in coordinating and leveraging this subagreement with other existing subagreements and for a coordinating and monitoring role of federal/provincial activities in Science and Technology. The Community Improvement Corporation (CIC) and the Federal Economic Development Coordinator (FEDC) as well as Commerce and Development, DRIE, the Ministry of State for Science and Technology (MOSST) and the National Research Council (NRC) will therefore play key roles on this committee as will other departments.

- E.2 The New Brunswick Science and Technology Council (STC) will have a strong overall advisory responsibility and leadership role for the strategic management of science and technology in New Brunswick, and will represent the principal vehicle for establishing an effective public/private partnership in this area. This Council will oversee Task Force work and will be supported by dedicated staff from the Department of Commerce and Development. The Council will have very strong members including individuals from outside the Province.

- E.3 The Technology and Economic Development division of the Department of Commerce and Development (TED) will have the responsibility for leading and coordinating science and technology and economic development initiatives in the province. It will also be responsible for providing staff support to the Science and Technology Council and to the Federal/Provincial Management Committee. The TED branch will also be responsible for monitoring contract activities to be performed by others as described below (e.g. Office of technology Assessment, Assistance and Transfer, Enterprise and Product Development Corporation, Manufacturing and Management Technology Centers, Technology Development Centers, etc.). The Industry and Business Services Branch (IBS) will also have a broadened responsibility for overall management of upgraded business and technology support services targeted to innovation and entrepreneurship (new businesses and new products) and often packaged by the Office of Technology Assessment Assistance and Transfer (E.4) and the Enterprise and Product Development Corporation (E.8).

The next four management initiatives are recommended to provide for a focusing of resources and capabilities on the four principal targets of science and technology strategy in New Brunswick - technology assistance and transfer, entrepreneurship and innovation, manufacturing and management technologies, and industry/technology development efforts in forestry/forest products, fishery/agriculture products, and minerals/materials. In summary:

- E.4 The RPC Contract Office of Technology Assessment Assistance and Transfer (OTAAT), under contract to the Research and Productivity Council from the public funds, will be responsible for directing the expanded technology Assistance Program, (A.1), packaging of the Matching Applied Research Grants, directing (A.4) Technology Demonstration Projects (A.5). It will also assist in coordinating delivery of other marketing and management assistance targeted to technology based businesses or products (A.2/A.3), and in coordinating innovation and product development support facilities and services at various facilities (A.8).

- E.5 The Enterprise and Product Development Support Office or Corporation (EPDC), under a new contract to the Province (Commerce and Development), and under oversight of the Science and Technology Council will be responsible for packaging start-up assistance and seed capital (A.6) and expanded venture capital support (A.7), as well as offering general enterprise and product development support and entrepreneurship initiatives (A.8 and A.9) targeted to new ideas, products, and entrepreneurs in the Province.

- E.6 The Manufacturing and Management Technology Council and Centres (MMTC) under an expanded contract to MTC from the Province (Commerce and Development) will be responsible for coordinating microelectronics automation, computer and management technology (C.1); for building the capabilities of the existing Manufacturing Technology Centre (C.2) and the Centre for Applications and Development of Microelectronics (C.3); for expanding into Systems Engineering and Integration (C.5) and for developing a parallel and significantly strengthened capability in management and marketing technologies and management information systems (C.4).

- E.7 The Industry/Technology Development Task Forces and Councils (ITTF) under short-term assignment from the Science and Technology Council and contract with the Province (Department of Commerce and Development) will be responsible for targeting and leveraging initiatives in three initial industry/technology development areas of focus: Forestry and Forest Product Technology development (particularly wood) through the Maritime Forestry Centre (D.1); Mineral and Material Technology Development (particularly related to fluidized bed technologies) through the Research and Productivity Council (D.2); and Fishery, Food, and Aquaculture Technology development (particularly aquaculture) initially through an Aquaculture and Fisheries Development Council (D.3). These industry and technology task forces, in conjunction with the Science and Technology Council and the Office of Technology Assessment Assistance and Transfer, will also be responsible for sponsoring periodic Technology Development Forums (D.4).

Figure III-2 illustrates the lead organizational responsibilities for each of the twenty-one program initiatives described in Chapter II.

The final three management initiatives are recommended to provide a better overall decentralized delivery system of technology assistance and transfer capabilities and services in the Province. In summary:

- E.8 The Network of Designated University/Laboratory Technology Transfer Agents (ULTTA) as a group of designated individuals representing each important university or laboratory facility, will be responsible for coordinating and monitoring technology transfer activities and potentials and for working with OTAAT and EPDC to assure the most effective use of technology resources and ideas in the Province.

- E.9 The Industrial Development Commissions (IDC), working with the Department of Commerce and Development, MMTC, OTAAT, and EPDC and the ITTF, will be responsible for establishing an effective communications network and decentralized delivery/outreach program for science and technology initiatives in the Province.

- E.10 The Research and Productivity Council (RPC). It is recommended that the legal/financial structure of RPC be shifted to permit it to pass through a maximum of tax benefits to private industry and to compete effectively on Federal DSS contracts. This will make RPC, as the strongest research and development organization in the Province, better able to serve the needs of business, industry and government throughout the Province. Under contract from the Province (Commerce and Development) RPC will also be responsible for managing the Office of Technology Assessment, Assistance and Transfer, and for leading the effort in minerals/ materials technology development.

Figure III-3 illustrates the organizational relationships of all ten management initiatives and 22 program initiatives. The remainder of this Chapter provides further description of each of the management initiatives.

E.1 Improved Coordination and Management of Federal/Provincial Subagreements Related to Science and Technology in New Brunswick - Establishment of a Broad Based Federal/Provincial Management Committee for the Proposed Federal/Provincial Subagreement on Industrial Innovation and Technology Development (to implement the Science and Technology Strategy)

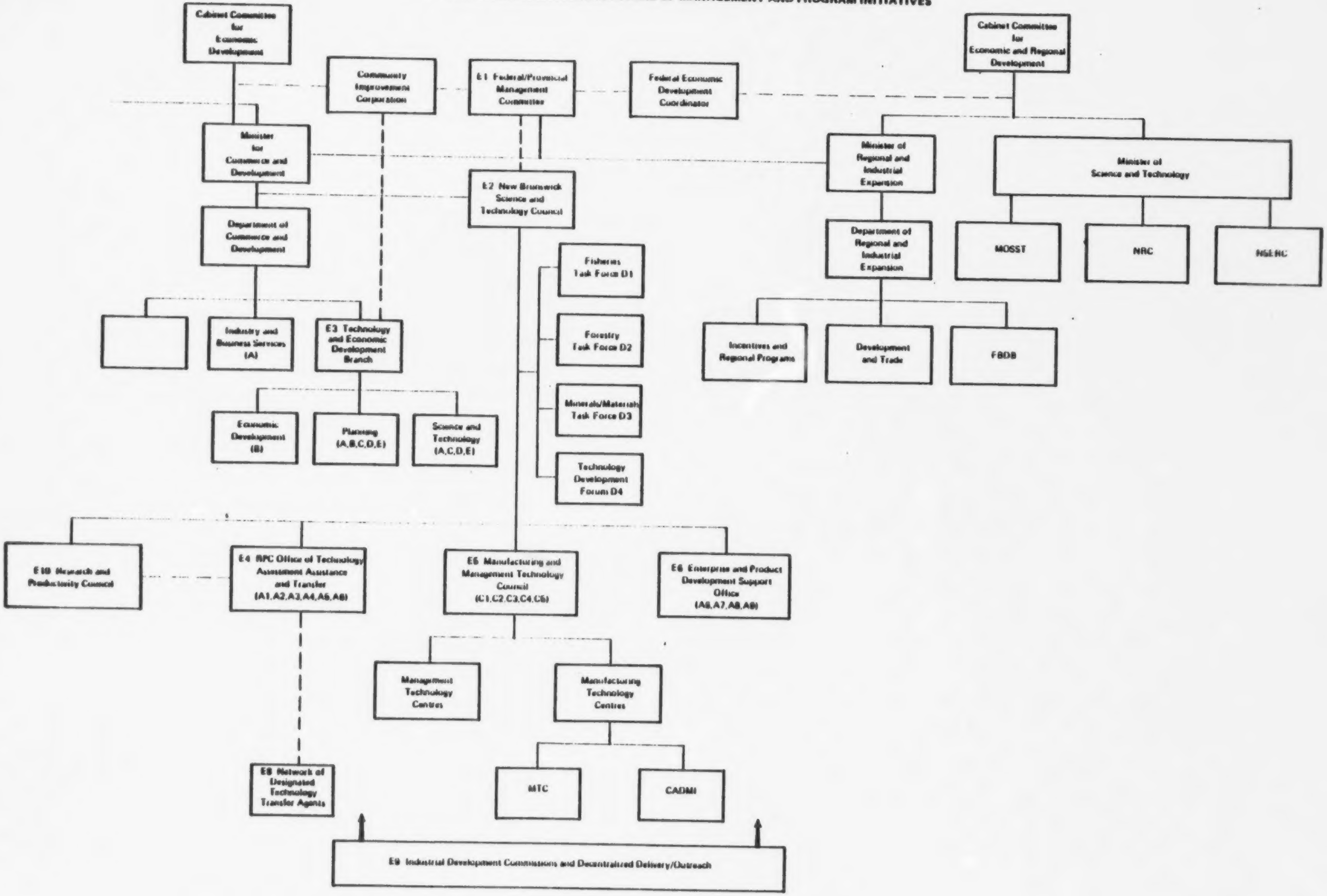
FIGURE III-2

RELATIONSHIP BETWEEN PRIORITY PROGRAM INITIATES AND MANAGEMENT INITIATIVES

	Provincial Commerce & Devlmt. Staff & Mgmt. Respon.				Focused Leadership & Development Responsibility Through the Science and Technology Council				
		Technology & Economic Development							
Priority Program Initiatives	Industry & Business Services	Economic Development	Planning	Science & Technology	Office of RPC Tech. Assmt. Asst. & Trans. & Tech Trans. Agents	Enterprise & Product Development Support Task Force & Office	Manuf. & Mgmt. Tech. Council & Task Force	Ind/Tech Development Task Forces & Councils	ADDITIONAL MGMT. RESOURCES
A1. Expanded Technology Assistance Program				x	x				1
A2. Upgraded Marketing and Export Assistance	x					x			1/2
A3. Upgraded Business Mgmt. and Planning Assistance Program	x					x			1/2
A4. Matching Applied Research Grants				x	x				1/2
A5. Technology Demonstration Programs				x	x				1/2
A6. Start Up Assistance and Seed Capital Support	x					x			1/2
A7. Expanded Venture Capital Support Program	x					x			1/2
A8. Enterprise and Product Development Support (Innovation Centers)	x			x		x			2
A9. Entrepreneurship Awareness and Development Program						x			1/2
B1. Expanded Service Sector Eligibility in Support Programs		x						x	1/2
B2. Procurement/Offset Policies Targeted to Build Technology Based Industry	x							x	1/2
B3. External Marketing Efforts Targeted to Technology Based Industry	x							x	1/2
C1. Management Manufacturing Technologies Council				x			x		1
C2. Manufacturing Technology Centre				x			x		0
C3. Centre for Applications and Development of Microelectronics				x			x		0
C4. Management Information Systems and Management Technologies				x			x		4
C5. Systems Engineering and Integration				x			x		1
D1. Forestry & Wood Products Technology Development		x		x				x	1/2
D2. Mineral & Material Technology Development		x		x				x	1/2
D3. Fisheries, Food & Aquaculture Technology Development		x		x				x	1
D4. Technology Development Forum		x		x				x	1
Additional Management Resources Needed (Estimated Person/Years)	1	1	1	3	2	3	5	Temporary	16

FIGURE III-3

OVERALL ORGANIZATION STRUCTURE OF MANAGEMENT AND PROGRAM INITIATIVES


Cabinet Committee for Economic Development
Community Improvement Corporation
E1 Federal/Provincial Management Committee
Federal Economic Development Coordinator
Cabinet Committee for Economic and Regional Development
Minister for Commerce and Development
Minister of Regional and Industrial Expansion
Minister of Science and Technology
E2 New Brunswick Science and Technology Council
Department of Commerce and Development
Department of Regional and Industrial Expansion
MOSST
NRC
NSERC
Fisheries Task Force D1
Forestry Task Force D2
Minerals/Materials Task Force D3
Technology Development Forum D4
Industry and Business Services (A)
E3 Technology and Economic Development Branch
Economic Development (B)
Planning (A,B,C,D,E)
Science and Technology (A,C,D,E)
Incentives and Regional Programs
Development and Trade
FBDB
E10 Research and Productivity Council
E4 RPC Office of Technology Assessment Assistance and Transfer (A1,A2,A3,A4,A5,A6)
E5 Manufacturing and Management Technology Council (C1,C2,C3,C4,C5)
E6 Enterprise and Product Development Support Office (A6,A7,A8,A9)
Management Technology Centres
Manufacturing Technology Centres
MTC
CADMI
E8 Network of Designated Technology Transfer Agents
E9 Industrial Development Commissions and Decentralized Delivery/Outreach

The recommended Science and Technology initiatives which will require support from the proposed federal/provincial subagreement will overlap and support a number of other federal/provincial agreements and initiatives -- particularly the proposed Industrial Development Subagreement, but also existing subagreements in fisheries, Forestry, Minerals, Tourism, and Agriculture.

In order to assure adequate coordination and leverage of these initiatives, the Community Improvement Corporation (CIC) and Federal Economic Development Coordinator (FEDC) need to be more active in the subagreement covering the science and technology initiatives than in other subagreements. In addition, adequate representation from agencies and institutions other than Commerce and Development and Department of Regional and Industrial Expansion will also be required (e.g. NRC, MOSST).

E.2 Improved Coordination of Key Science and Technology Initiatives in the Province - A Recommended New Brunswick Science and Technology Council with a Strong Business/Industry and Economic Development Orientation

In order to provide a focus for private sector participation and leadership in directing Science and Technology initiatives to practical economic development objectives (see Appendix B), this management initiative will provide for a strong advisory council which will work with the Technology and Economic Development Branch of Commerce and Development, MTC and CADMI, RPC, a New Brunswick Product Development or New Ventures Corporation, and a New Brunswick Office of Technology Assessment, Assistance and Transfer. This council will have a mandate to maximize the leverage of Federal and provincial science and technology expenditures in terms of both private technology development activities and economic development in the province. They will play a major role in the management of the Province's Science and Technology strategy and related federal/provincial subagreements. They will also be responsible for monitoring intergovernmental activities and coordination, as well as the effectiveness of government/ institutional/industry partnerships. This council (or board) would essentially be a super-board of selected members of its constituent governing and advisory bodies. Its influence would be derived primarily from the strength of its members and the stature accorded the board by the Province, and initially from its influence over the targeting of funds in the proposed subagreement for Industrial Innovation and Technology Development.

It is recommended that the Council be staffed by a strong Executive Director and 2-3 assistants who would be seconded from other Federal or Provincial departments and the private sector.

The Council would initially have a series of industry/technology Task Forces which would formulate strategies for how to best leverage a series of science/technology and development initiatives to achieve results in targeted industries (e.g. Aquaculture, Wood Products, Minerals). It is recommended that these Task Forces be led, in each case, by a paid part-time team of seasoned industrialists/technologists (the elder statesman) (1-2) and high-energy entrepreneurs/innovators (1-2) (the young turks) under short-term contracts. The Council and Task forces would work with the Canadian Manufacturers Association, the Industrial Development Commissions, and the Counseil Economique de Nouveau Brunswick in these efforts.

Other options investigated but rejected included a much weaker Science and Technology Advisory Committee, a much stronger Science and Technology Corporation (a la New York State) and increased industry representation on all relevant boards and committees.

E.3 More Effective Management of Provincial Government Science and Technology Development Activities - A Technology and Economic Development Branch with a Science and Technology Division in the Department of Commerce

In order to sustain clear commitment and leadership for science and technology in the Province and in order to provide a basis for interdepartmental management of science and technology initiatives related to major development initiatives, this management initiative will provide the basis for consolidating technology and economic development management in one location and for granting it sufficient responsibility to assure interdepartmental coordination and effectiveness. This management organization is recommended to include an adequately staffed science and technology division (currently limited to one staff person), a planning division (currently in existence), and a development division (currently not in existence but with some staff responsibilities elsewhere).

This initiative would help the province get the most leverage from the Science and Technology initiatives outlined earlier by assuring their link to existing subagreements and development initiatives in Fisheries, Forestry, Mining, Tourism and elsewhere. This will assure that Science and Technology initiatives are managed to serve critical economic development initiatives in the province rather than their own ends (as has occurred in other provinces and states). This will also assure effective policy strategy and program review.

This branch will also be responsible for providing staff support to the Science and Technology Council and its Task Forces and to the Federal/Provincial Management Committee. It will also be responsible for monitoring oversight of the overall Science and Technology strategy and particularly of the initiatives under Strategy B (Technology Based Industry Development), Strategy C (Strengthened Engineering, Manufacturing and Management Technology Resources) and Strategy D (Upgraded Science and Technology Resources and development initiatives in targeted industry/technology areas) as well as parts of Strategy A.

The Industry and Business Services Branch would have primary responsibility for delivery and coordination of initiatives under Strategy A (Strengthened Support System for Innovation, Entrepreneurship and Technology Development and aggressive promotion of applied research, technology transfer and commercialization).

Other options investigated but rejected included a similar organization lodged in the Cabinet Secretariat, a separate Science and Technology Secretariat with less clout and a lower profile, or a coordinating function at C&D with continued fragmentation and autonomy of Science and Technology activities of line departments.

E.4 Focused Management of Technology Assessment, Assistance and Transfer - Through an Expanded New Brunswick Office of Technology Assessment, Assistance, and Transfer at the Research and Productivity Council

In order to provide a solid direction and focus for the technology assessment, assistance, and transfer activities that are so central to the New Brunswick Science and Technology Strategy, an expanded office of Technology Assessment, Assistance and Transfer is recommended. It is recommended that this office be managed under a multi-year contract to the Research and Productivity Council from the Province and the National Research Council. This office would be designated as the central repository of Science and Technology Information and would be responsible for managing both the Information System and the overall technology assessments, assistance, and transfer activities in the Province. This office would have strong connections to the Industrial Development Office at NRC through the IRAP coordinator recently located in New Brunswick by the NRC. This office would also have very strong connections to the Industrial Development Commissions, and the universities, laboratories and their agents. This office would be required to optimize the use of technology resources in the Province and the leverage of technology resources from outside the Province.

Other options investigated but rejected included no office, with just a network of agents (as described in E.8); and a more centralized Technology Center or Program at Commerce and Development, RPC, the universities, or an NRC laboratory.

E.5 Management of New Product and New Venture Initiatives in the Province - A Recommended New Brunswick Enterprise and Product Development Support Office or Corporation

Innovation Centers and New Business Incubators are currently the rage of economic and technology development efforts throughout North America and Europe. These initiatives tend to have three major components: shared services/equipment and experiences, flexible land/building arrangements, and financial assistance/support. While the provision of new flexible land and building arrangements does not appear to be a priority need in New Brunswick, an institutionalized support system of services, experience, and finance does appear to be critical (as discussed in Chapter II-A.8 and A.9).

The recommended New Brunswick Enterprise Development Support Office or Corporation would have as its mandates the long-term improvement of the climate for entrepreneurship and innovation, as well as the short term provision of packaged services and shared experiences for individuals at all stages of the product or venture development process. This organization would work very closely with the Industrial Commissions and provide support services to Commission efforts to encourage and support new enterprises in their regions. It would have a key responsibility in the packaging of SIFAP and IRAP services as well as other financial and technical assistance services available or targeted to new enterprises but administered by others. It would operate under contract to the Department of Commerce and Development under oversight of the Science and Technology Council and would be initially staffed very leanly until the demand for its services become clearly established.

Other options investigated but rejected included a more facility-oriented series of innovation centers and new business incubators, a more narrowly defined product development or investment corporation, a much looser initiative based on shared experiences (e.g. the MIT Enterprise Forum), and a continuation of the current approach with innovation and entrepreneurship initiatives sponsored by the Department of Commerce and Development.

E.6 Management of MTC and CADMI - A Recommended Transition to a Consolidated Management Team for Manufacturing Technologies; and a Recommended Management Center to be Administered Jointly with the Manufacturing Center

In order to provide for effective management and coordination of a variety of manufacturing technology initiatives taking place at various institutions (D.2, D.3, D.5) and in order to assure effective service delivery, a consolidated management team is recommended to begin as soon as practical. Other options investigated included consolidation now or continued separate management.

In order to provide a focus for the efforts to develop upgraded management technologies and services (D.4), it is recommended that a Management Technology Center be established as a division of the Manufacturing and Management Technologies Ccenter. These two centers should be managed together through the facilities and capabilities of UNB, UdeM, RPC, and the community colleges (D.1), with other outreach provided through the industrial commissions. This significant expansion of the Manufacturing Technology Centre approach to incorporate important management technologies will require establishment of a task force and an eventual broadening of the MTC board and internal reorganization. It would continue to have the five part role of MTC-research, education, training, technology assistance and technology transfer. Other options investigated included an ad-hoc approach for service delivery through the Department of Commerce and Development.

E.7 Coordination and Management of Technology Development Centers and Initiatives - Recommended Industry/Technology Development Task Forces (ITTF) or Council to Oversee Coordination of Major Technology Development Initiatives and Subagreements Affecting These Initiatives

While there does not appear to be the need for a centralized board or governing structure for the technology development initiatives (other than at Commerce & Development and Science and Technology Council), there is likely to be considerable transferability of experience and lessons learned from these initiatives. We have, therefore, recommended establishment of task force reporting relationships to both the Department and the Science and Technology Council. Oversight and coordination critical technology development initiatives -- particularly those in Forestry (with an initial focus on Wood Products), Fisheries (with an initial focus on Aquaculture), and Minerals/Materials (with an initial focus on fluidized bed technologies) would occur through this process.

The Industry/Technology Task Forces (ITTF) would be the principal vehicles of this management initiative. As described in E.2, these Task Forces, along with the Department of Commerce and Development and other institutions would have the responsibility for developing more targeted strategies for maximizing the leverage of limited resources in each targeted industry/technology area.

E.8 Management of University and Research and Development Laboratory Efforts in Technology and Economic Development - A Recommended Network of Designated Technology Transfer/Assistance Agents at Each Institution

In order to provide the best basis for an effective information network of Science and Technology resources, contacts, and experiences, it is recommended that each institution be required to designate technology transfer/assistance agents from existing staff. These agents would meet regularly to share information and experience and to increase their own capabilities. They would be required to report regularly on their progress with technology assistance and transfer and to report their recommendations on ways to expedite the process. These agents (including representatives of NRC and other federal labs) would together represent a working committee of the Science and Technology Council who would report their results and findings to the Council, to the Science and Technology Division of the Department of Commerce and Development, to the Industrial Development Commissions, and to the Office of Technology Assessment, Assistance, and Transfer.

In general, these responsibilities would be assigned to existing staff of the universities and research labs.

Other options investigated but rejected included centralized management and control of these agencies, and technology transfer/assistance activities of each institution, and continuation of the status quo completely decentralized approach.

E.9. Management of a Decentralized Delivery and Outreach System for Management and Technology Support Services - A Recommended Service Delivery and Outreach Role for the Industrial Development Commissions in Management/Technology Support Targeted to New Enterprises and Technologies

It will be necessary to centralize the technical capacity in many of the areas required to effectively support the development of new enterprises and technologies in the Province. However, a decentralized delivery and outreach system will also be essential. This system will support the effectiveness of the important clusters of science and technology initiatives that are oriented to the encouragement of new enterprises and technologies throughout the Province.

To perform an effective role in the outreach and delivery process, Industrial Development Commissioners and their staff will have to be better trained in the enterprise and technology development resources available, more aware of the network of institutions and individuals to tap, and more familiar with potential economic and technology development problems and opportunities in their regions. A combination of management/training seminars for Industrial Development Commissions, computerized linkages to key information bases, maintenance of responsive hotline services, and more aggressive outreach by key institutions should meet this need. It will probably also be both desirable and necessary for some of these institutions to operate aggressive outreach activities through the Industrial Development Commissions, either with their own staff or that of the Commissions. In each case, the Industrial Development Commission should have very strong connections at the designated business development agents or centers in its region, whether it be UdeM, UNB, RPC, or the community colleges. The designated business development agents or centers should be centrally coordinated by the Department of Commerce and Development.

In each case, the Industrial Development Commission should have very strong connections at the designated business development agents or centres in its region, whether it be UdeM, UNB, RPC, or the community colleges. The designated business development agents or centres should be centrally coordinated by the Department of Commerce and Development.

Industrial Development Commissions should also play a pivotal role in pro-active activities associated with entrepreneurship (entrepreneurial recognition and junior achievement programs, enterprise seminars or forums). Finally, as a function of their pivotal role in outreach and service delivery, the Industrial Commission should also play a key role in the monitoring and updating of the Provincial Science and Technology Strategy.

Other options investigated included having the Chambers of Commerce or industry/trade associations as an outreach network, greater dependence on a centralized delivery system with circuit riders, and a regional office of various programs/initiatives.

E.10 Management of the Research and Productivity Council (RPC) - A Recommended Shift in Legal/Financial Structure to Permit Pass Through of Maximum Tax Benefits and Competitiveness on DSS Contracts While Providing Assurances to the New Brunswick Science and Technology Community That It is Making Best Use of All Public and Private Institutions in its Management of Government Contracts

In order for RPC to best serve the Province and the interests of economic development, its efforts to change its status should be supported to the extent necessary to improve credibility and expand competitiveness for both government and industry contract research. There are a number of options for accomplishing these ends which were beyond the scope of this work.

However, whether RPC becomes fully private and autonomous from the Provincial government, or if it remains as is, a separate management structure (an affiliate or subsidiary) and a separate management committee (an advisory/review board or committee) will probably be required to oversee its substantial lead management and administrative responsibilities for some of the program initiatives outlined in this strategy (e.g. technology assessment assistance and transfer, Mineral/Materials Research).

Other options investigated included having RPC become an exclusively private contract research organization, or having it become much more closely affiliated with the network of other university and government labs in the Maritimes.

APPENDIX A

PRIORITY INITIATIVES

APPENDIX A.1

FORESTRY AND FOREST PRODUCTS TECHNOLOGY DEVELOPMENT

FORESTRY-RELATED TECHNOLOGY INITIATIVES

RATIONALE

New Brunswick's forestry sector has been the traditional mainstay of the Provincial economy, and it is the industrial mainstay of 33 of New Brunswick's 67 single industry communities. Broadly defined, the forestry industry directly employs 16,000 people, and indirectly accounts for an additional 20,000 employees in other industries. Among the key forestry activities in New Brunswick are: pulp and paper, sawmilling and lumber production, wood products manufacturing, and timber resource management, logging. These activities are described in more detail in Attachment A.

New Brunswick's Forestry-Technology Resources and Needs

The Hugh John Fleming Forestry Centre, currently under construction at Fredericton, represents the results of many years of planning and is the logical focal point for future technology activities related to forestry. To establish the Centre, the Federal government along with the Provinces of New Brunswick, Nova Scotia, and Prince Edward Island and the University of New Brunswick have committed $79 million to build research, teaching and laboratory facilities. The Centre will also have conference and other support facilities in 15 buildings with a total of over 500,000 square feet of space. Associated with the Centre are the following:

- Maritimes Forestry Research Centre. The federal research laboratory is to relocate to the Centre. Research has been carried out at this laboratory in the full range of forest fields, from physiology to silviculture and budworm population dynamics with a particular emphasis in recent years on budworm control, hardwood management and nutrient research associated with tree growth. A considerable expansion of laboratory facilities is planned.

- University of New Brunswick's Faculty of Forestry Research Laboratory. New research facilities will be provided at the new Centre. At present, the UNB Faculty of Forestry conducts research for industry, including in tree improvement, soils, forest products and logging equipment. The UNB Forestry Faculty is recognized within North America as strong institution in its field.

- New Brunswick Department of Natural Resources. The Centre will be the headquarters of the DNR's forestry management staff. DNR is responsible for the planned management seven million acres of land. DNR commissions contract research, and its presence at the Centre will improve the interface of the government and university labs with the industry. The nature of planned research has not yet been identified, nor has the extent to which it will be applied or basic.

- Maritimes Forest Ranger School. The new school will be located at the Centre with expanded teaching facilities, including a sawmilling training facility and other support facilities, which will also allow testing of sawmill instrumentation.

At present, there is no direct industry participation or financial support for the Centre. Our discussions with industry throughout New Brunswick indicate that there is a strong interest within the forestry sector's industrial community to participate in the Centre, if the activities are of interest and if the mechanisms are in place to facilitate their participation. We believe that the full participation of individual companies and industry groups, such as the New Brunswick Forest Products Association and the Research Committee of the Chief Executive Officers is vital to the success of the Centre.

The Centre does not have clearly stated development strategy; rather each participant has its own objectives. We believe that a strategy should be developed which both reflects the current and future needs and opportunities of New Brunswick's forestry industry and seizes the unique opportunity presented by the Centre to expand forestry research and stimulate technology transfer to New Brunswick industry.

Among the areas in which the New Brunswick forestry and technology expertise represent both a strength and an opportunity for development are:

- Forestry management equipment and services--building from the resources of the UNB Faculty of Forestry and other institutions, a number of innovations have been developed in recent years, including devices for more rapid, precise measurement of tree growth and log buts, and the use of geographic information systems for planning resource management. This latter will change the nature and practice of forestry management.

- Silviculture-related opportunities--with a strong recognized capability in silviculture, New Brunswick's forestry institutions are likely to be in a strong position to pursue or at least capitalize upon biotechnology and bioengineering applications in silviculture.

- Forestry products and processing technology--through the combined expertise of New Brunswick's forestry research institutions and consulting firms and drawing upon the expertise of institutions outside the Province (e.g., Forintek and others noted below), New Brunswick saw mills and other wood product manufacturers should be stimulated to establish a leadership in process technology and equipment and take new ideas to market. To accomplish this, firms need to be provided increased awareness of technology applications and their associated potential benefits as well as access to facilities for one-off problem solving.

To effectively capitalize upon these strengths, a priority need related to forestry activities is:

- Marketing and export assistance--perhaps the strongest need of forestry-related businesses, particularly smaller to mid-sized firms and those considering new product opportunities, is the need for appropriate marketing strategies, particularly where there is a need to enter new export markets to be successful.

Forestry Research Resources Outside of New Brunswick

New Brunswick should consider its competitive position to pursue forestry-related technology development and spin-off opportunities given the strengths of its natural resources and its research and technology institutions. This must be considered within the context of comparative research centers and expertise in other provinces and locales outside of Canada. These "other" centers must also be considered for their potential assistance to New Brunswick's needs, if the appropriate linkages are established. Among the more important of these "other" centers or institutions are:

- Forintek, drawing half of its support from industry, remainder from provinces and the Federal government. Labs are located in Ottawa, Vancouver, and Quebec City, the latter under construction; Forintek has 20 specialized research and technology applications areas, which encompass:
  - wood utilization (housing, light construction),
  - wood engineering,
  - wood science and preservation (growth projection, preservation, tree maintenance, density analysis), and
  - biotechnology.

- Forest Engineering Research Institute of Canada, which is sponsored by the Canadian logging industry and has research laboratories in Vancouver and Montreal. FERIC has specialized in research on logging equipment and ergonomics.

- Pulp and Paper Research Institute of Canada, which is a joint research and information center for the Canadian Pulp and Paper Association, Canadian Department of the Environment and McGill University; PAPRICAN is involved with graduate student research and exchange programs; it has a staff of 215. Key research areas include: pulp and paper technology (chemical, mechanical) and paper products.

- Forestry Research Development Foundation, with a Quebec-staff of 40, specializes in silviculture, nutrition, industry supply.

- State University of New York at Syracuse, providing research and technology application assistance to New York State's forestry sector, which bears some similarities to New Brunswick's.

- Oregon State University at Corvallis, which conducts research in forest products, product research, forestry science and forestry engineering. They provide a data base of most recent research. People come to use this database and update it with the newest technologies.

- U.S. Forestry laboratory and experiment stations, among the more relevant of which are:
  - Forest Products Laboratory in Madison, Wisconsin; and
  - Northeastern Forest Experimental Station in Broomal, Pennsylvania.

Each of these centers and others noted in Attachment B, represent a potential resource and example of "lessons learned" for New Brunswick's forestry sector and associated technology institutions. These institutions must also be considered in terms of their competitive expertise, that is, the extent to which they already hold a leadership position or edge in a specific technology area.

It is based upon this background that the following initiatives are recommended.

OBJECTIVE

The objective of forestry-related initiative is to have the present participants, in collaboration with industry, develop a targeted strategy for the Centre which is focussed on ensuring the most effective development and utilization of forestry technologies possible in order to enhance forestry product opportunities in the Province. To accomplish this will require substantial private sector participation.

ACTIONS

The Maritime Forestry Centre Corporation represents the logical umbrella organization through which initiatives can be pursued. Simultaneously, two first steps are necessary:

- Marshall Private Sector Participation and Support--At this very early development stage, aggressive outreach efforts are needed to attract the participation and involvement of private sector interests in New Brunswick. Among the collective interests to be targeted are the New Brunswick Forest Products Association, the Maritime Lumber Bureau, the Association of Forest Engineers, the Association of Professional Engineers, and others. The key companies who represent the "movers and shakers" in the forestry sector should be targeted individually and asked for their views and interest in the Centre, and their own needs in terms of desirable functions the Centre might provide.

- Long-Term Strategic Plan for the Hugh John Fleming Forestry Centre. A strategic plan for the Centre should be developed and implemented. We recommend that a Task Force be assigned to this task drawing a majority of its representation from the private sector and include the directors of the participating research institutions.

The strategic plan should identify priority directions, functions and implementation procedures for the Centre. Among the priorities which should be considered for inclusion are the following:

- Organizational Structure. The Board of Directors should draw more than half its representation from the private sector as well as representation from each of the affiliated agencies. The Centre should be managed by a senior level Executive Director supported by a small core team. The Executive Director will be given the mandate and resources to implement the strategic plan. In addition, the executive director should provide for effective coordination of available resources and the activities of affiliated and other institutions.

- Joint Private-Institutional Research Efforts. The Centre should establish the ways and means necessary to attract and facilitate private sector sponsorship and/or participation in research efforts at the Centre. At present the Centre has physical space which could be utilized by the private sector in joint research endeavors. These endeavors can be pursued on an individual or collaborative basis by companies with researchers affiliated with the Centre. An example of such a mechanism is the Microelectronics Centre of North Carolina--the capital cost of offices, laboratories and other facilities was funded by the state and companies participants were targeted as "members". Company "membership" entails fees to support operating and program costs. In addition, university professors are affiliated with the Centre to pursue research projects. Participating companies can assign their own staff to the Centre and pay annual fees to cover operating expenses and individual research projects. Research is conducted jointly or individually. Other mechanisms can be considered which would involve charging fees or lease rates to recover a portion of the capital cost invested in the Forestry Centre, and to cover operations costs and consulting arrangements with individual researchers. Research efforts will be chosen on the basis of need as determined by the private sector together with researchers. This initiative will be important to providing the Centre with a market focus and a mechanism to attract private sector segments.

- Forestry Management Technologies and Instrumentation--An existing strength of New Brunswick forestry institutions, this should be maintained and highlighted as a focus of expertise within the Centre. A stronger environment and focal point of supporting resources are needed for such innovations as measurement instrumentation and mapping devices and techniques. The strength of UNB's Faculty of Forestry provides the potential to spawn similar innovations which might have market potential beyond the borders of New Brunswick or even the Maritimes. Within the Centre, there should also be a capability to monitor world-wide competing and complimentary technologies; and to provide a point of contact for innovators and entrepreneurs to other supporting business, financial and technical assistance services.

- Forestry silviculture and biotechnology--The Centre should carefully consider the extent to which its affiliated institutions are in a strong enough position to aggressively pursue biotechnology applications to silviculture. This very young technology offers significant promise for silviculture practices and has been referenced in the 1984 Federal-Provincial Subsidiary Agreement on Forestry Resources. This should be leveraged to pursue a research program at the level necessary to maximize New Brunswick's competitive strengths in silviculture research. The budworm and other disease control research provides New Brunswick with a potentially competitive edge in forestry-related biotechnology.

- Extension service. A comprehensive extension service should be established within the Centre, pursued in a fashion similar to the U.S. forestry and agricultural extension programs. This service initially should include two or three staff, with at least one drawn from Forintek (therefore with direct linkages to Forintek's expertise) and funded by the Centre (Province). The extension service staff should maintain a very visible field presence, reaching out to forestry businesses regularly, and securing the trust and confidence of those businesses as a reliable and qualified first contact to assist directly or access appropriate assistance in a variety of technical needs. An important aspect of this service will be quick and timely response to questions or requests for assistance by businesses. In addition, the service should be the focal point for a forestry technology information service. The State University of New York forestry extension service is a good example of the type of service that should be provided. Among the areas of assistance which should be directly provided by the extension service staff in New Brunswick are:

  - Saw mill technologies, including technical assistance in making saw mill operators aware of the technologies and, more importantly, potential benefits associated with application. This might also include a "saw mill improvement program" such as provided by the U.S. forest service to conduct free technology and operational audits of individual saw mills and recommend improvements.

  - Wood products-related, to assist saw mill and other forestry-related businesses in considering the potential for and needs associated with wood products development opportunities. This will be important in assisting saw mill operators to become less dependent on the commodity market.

  - Marketing and export, to assist forestry related business in more adequately considering new markets for their products and services. It will be important that the extension service staff and Centre, overall, maintain adequate linkages to sources of marketing and export expertise outside the Centre and Province to insure that sound advice is readily available.

RESPONSIBILITY

The Board of Directors of the Maritime Forestry Centre Corporation should continue to provide leadership for these efforts, with increased involvement of the private sector on the board and in funding research as outlined above. There should also be the continued involvement and participation of the affiliated forestry institutions.

RESOURCES

Resources beyond those already committed to the Centre for construction should be provided from the existing ERDA agreement and other sources as follows:

- Board of Directors and General Manager/core staff of the Centre--funded by government and partially by private associations.
- Joint research efforts--funded wholly or on a matching basis by the private sector.
- Support expertise for forestry management technologies and research in biotechnology applications to silviculture should be funded by government.
- Extension services should be funded by government based on experienced gained from other technology extension efforts such as the Manufacturing Technology Centre.

ATTACHMENT A.1

NEW BRUNSWICK'S FORESTRY SECTOR

New Brunswick's Forestry Sector

As outlined in the Federal Provincial Subsidiary Agreement on the Forestry Sector the forests have long been the mainstay of the Province's economy. The sector plays an important economic role in all regions of the Province, in both rural and urban economies. It forms a key component of the industrial base in all major urban centers with two exceptions, where the industry is still present in a secondary role. In 33 of the 67 single industry communities in the Province, forestry represents the only industry.

New Brunswick has the highest percentage of total land area in forest production of any province in Canada. There are 6 million hectares of productive forest land in the Province which represents 85 percent of the land area. The Crown owns 49 percent, 2 percent of which is Federal, while the remaining 51 percent is privately owned in large (18 percent) or small (33 percent) parcels. Approximately 40 percent of the private forest land is owned by the processing industry. The total stock of merchantable timber is 515 million cubic meters of which 65 percent is softwood and 35 percent is hardwood.

This resource supports the Province's largest industry. The gross value of its production is over $1 billion, and it accounts for almost a quarter of all goods produced in the Province and more than 9 percent of the Province's G.D.P. Forest related exports equate to 38 percent of the provincial total.

The sector provides direct employment for over 16,000 persons while another 20,000 are employed in other industries or services dependent on the forest industry or the income it generates. In total, the sector, both directly and indirectly, generates one job in seven in the provincial economy, and provides over $250 million in wages and salaries to those it directly employs.

There are two major segments: the management, harvesting and delivery of timber; and, the processing of this timber into manufactured products, i.e., from sawn rough lumber to finished furniture and from pulp to finished newsprint.

The processing of timber products provides over two-thirds of the forestry sector's employment, approximately one-third of the manufacturing sector's employment and 40 percent of manufacturing output.

The wood industries group is dominated by sawmilling. There are 99 sawmills in the Province whose operations are considered to be at a commercial level. Only 47 have a normal production rating of greater than 2 million board feet annually; of these, 13 are rated at 10 million f.b.m. or greater, 13 between 10 and 5 million f.b.m., 13 between 5 and 3 million f.b.m. and 8 between 3 and 2 million f.b.m. Almost two-thirds of the Province's sawmilling capacity is owned by the pulp and paper industry as part of an integrated operation. All 8 mills with capacities in excess of 25 million f.b.m. annually are owned by the pulp and paper industry. The wood industries require 40 percent of the total roundwood delivered for processing but utilize only 20 percent of the total fiber used by the forest industry. Almost one third of the production of the wood industries group is marketed internationally, while almost one-half of the timber production is exported. While the United States continues to be the major export market, its share has declined to less than 40 percent while the United Kingdom's share has increased to 36 percent of the lumber exported.

During the decade of the 1970s the industry experienced significant expansion. Values of output, employment, exports and timber utilization all increased.

In the wood industries, the value of shipments increased by 63 percent, value added by 58 percent and exports by 125 percent, in real terms. Lumber production reversed the declining trends of the late 1960s and reached a record level of 473 million board feet in 1980. Production volume increased by almost one third over the decade. While the number of mills continued to decline and employment decreased, major investments in the industry, particularly in mills owned by the pulp and paper companies, resulted in major expansions of the larger mills. As a result, productivity and total wood fiber utilization increased. The growth of the wood industries as a group, particularly in employment and value added, resulted mainly from expansion in shingle and plywood production and the addition of a waferboard plant.

In the logging segment of the forest industry, the volume of output (the harvest) increased by 25 percent over the decade. In 1980, the industrial timber harvest reached a high of 9.3 million cubic meters. Significant improvements in productivity resulted in only a modest increased in logging employment.

New Brunswick contains 2.8 percent of the productive forest land in Canada and 2.6 percent of the total merchantable growing stock. However, in spite of this limited resource, the Province contributes 5.4 percent of the total national harvest. This relatively intensive utilization of the Province's timber resource, twice the national average (2.27 times the national average for softwood), indicates why the future development of the forest industry is highly dependent on the timber resource base.

The pulp and paper allied industries group is the largest component of the forestry sector accounting for 60 percent of employment and 70 percent of the value of output. Six of New Brunswick's 10 major pulp and paper mills have undertaken or completed modernization programs at a total investment cost of some $750 million, in part assisted by the provincial and federal governments (reference: Federal Provincial Subsidiary Agreement, 25th June).

APPENDIX A.2

MINERAL TECHNOLOGY DEVELOPMENT

MINERAL TECHNOLOGY DEVELOPMENT INITIATIVE

BACKGROUND

Large private sector investments in the mining sector in the 1970's and early 1980's have sharply increased sector output and made a major contribution to the New Brunswick economy. A key element in the Province's Economic Development Strategy for the 1980's is to promote further investments in mineral resource development and processing with the stated objective to at least double the sector's gross value of output over the decade, to one billion dollars, and to increase employment dependent on the mining sector from 4,000 jobs in 1981 to above the 8,000 level by 1990.

Major economic development opportunities include:

- Further development of the Province's large base metal reserves, (now only two mines in production).
- At least one new potash mine (in addition to the PCA and Denison projects).
- New zinc reduction facilities to process presently exported zinc oxides.
- Further processing of antimony concentrates.
- Further processing of potash into such secondary chemicals as potassium sulphates for the fertilizer industry and potassium-based chemicals for offshore oilfield supply services industries.
- A small thermal power station in the early 1990's burning a mixture of coal and oil shale.

Research and development has as an important role to play in realizing economic development opportunities in mineral resource development and processing:

- Enhancement of the viability of marginally economic mineral deposits, particularly as to increasing recovery yields from base metal deposits, and decreasing NOX and SOX emissions in the burning of New Brunswick's high sulphur coals.
- Enhancement of the investment attractiveness of resource processing through technological process developments, for example, related to potassium chemical production and manganese technology developments.

- Exploitation of by-products and waste from mining and smelting operations such as for example use of NaCl brine from potash mining to produce sodium sulphates and use of pyrite wastes as the sulphur source for sulphate chemicals.

Considerable progress has been made in the Province in some areas of research, the most promising of which include:

- The RPC Sulphation Roast-Leach Process now being tested in a pilot plant. It is reported that this process could increase metal recovery by up to 30 percent for the two existing producers and 75 percent or better from presently undeveloped properties. The SRL process is now being tested at the ERS pilot plant located at Chatham and is reported to have generated considerable industry interest.

- New Brunswick Power's research on circulating fluidized bed co-combustion of New Brunswick sulphur-rich coals and oil shales. The Chatham power station is being used to demonstrate the developed technology at demonstration.

- The RPC/New Brunswick Power research on distributed mixing burner technology directed at using oil shale as a fluid bed scrubber medium rather than limestone to remove SO_2 from high sulphur coals.

- The RPC research on the retorting of oil shales in a combustion retort mode funded by Provincial Holdings Ltd. and the National Research Council.

We do not have a good understanding of what research work is being done by the multinational mining companies operating in the Province. We assume that the research work that is being done in the Province is mostly applied, directed at increasing productivity; and that the bulk of their research work would be carried out in central laboratories located in the United States, Ontario and Quebec. It should be noted that there appears to be a trend emerging in the industry worldwide to contact more research work to independent contract research firms, such as RPC, while reducing, and in some instances eliminating, internal research activities.

New Brunswick companies and research groups can also draw upon the expertise and facilities of other Canadian and international research institutes. In deciding to direct resources to specific research areas, consideration needs to be given to what is being done elsewhere and how such expertise and facilities might be assessed. Such research centres as CANMET, the U.S. Bureau of Mines, Battelle, etc., should be viewed as potential sources of expertise as well as being considered in terms of their competitive expertise, that is, the extent to which they already hold a commanding leadership position in a specific technology area.

We believe that it is important to build upon existing research programs and the technical expertise of RPC, the mining industry and the university and consulting engineering communities. Not only do the economic development opportunities appear to be significant, they are consistent with the Province's desire to diversify its economic base, and clearly research and development has an important role to play in their realization. The Province's science and technology resources in metallurgy are sufficiently strong, we believe to give some promise that a concentration and upgrading of science and technology resources in this area will yield longer term benefits to the Provincial economy and to the growth of the Science and Technology Community.

PROPOSAL

We believe that a Task Force should be set up to define:

1. A new Mineral Technology Development Initiative, which would become the focal point for marshalling public and private sector science and technology resources to support and encourage mineral resource development and processing in the Province. Ideally, this initiative would involve the leading companies in the New Brunswick mining sector, such as, New Brunswick Power, the Research and Productivity Council and the National Research Council, and be structured in such a way as to allow the participation of the university and other private research groups on a full or selective basis. The above entities should be represented on the Task Force.

2. We envisage that this new initiative would initially build upon the research programs of the RPC Mineral Development and Processing Department including, the SRL Pilot Plant program and the New Brunswick Power/EMR demonstration circulating fluidized bed technology for burning coal/oil shale mixtures.

3. Longer-term, we would hope to include public-private sector research and demonstration projects. If the Task Force determines that it is possible and desirable to recommend establishment of a new Centre, possibly doing the lines initially proposed by RPC in 1983, we would recommend consideration of the following mandate:

   (i) To work with New Brunswick industry to develop processes and to adopt existing processes;

   (ii) To test and evaluate existing and new technologies best suited to advancing technological growth in the region;

   (iii) Through bench scale research through pilot demonstration in select technologies to assist in the transfer of technology to industry;

(iv) To further develop research capabilities and expertise on problems related to a) metal and by-product recoveries from complex base metal deposits, b) co-combusting of oil shale and high-sulphur coals;

(v) To upgrade bench scale R&D capabilities in technologies related to using Provincial resources in chemical production;

(vi) To involve New Brunswick companies to the maximum extent possible in the research program, including joint venture research, access to facilities for the testing of proprietary technology etc.; and

(vii) To attain self-financing through contract research and fees for complex facility use within five years.

We would also recommend that the Board of Directors of the Centre include representatives of the mining industry, engineering consulting community, the two universities and RPC. RPC would be well-positioned to manage any such new initiative, although consideration should be given to setting up a separate core management group.

We believe that involvement of the mining sector is critical to the success of any initiative in this area and consequently it is important that the Task Force ascertain the research needs and priorities of New Brunswick mining companies to determine the new or existing research programs they are willing to support. Private companies should also be pressed to identify possible joint venture research programs.

RESOURCES

The resource requirements of any new initiative should be met through ERDA and private sector participation and funding in selected research projects.

APPENDIX A.3

FISHERIES AND AQUACULTURE TECHNOLOGY DEVELOPMENT

MARINE SCIENCES AND AQUACULTURE TECHNOLOGIES

BACKGROUND

New Brunswick's fisheries sector ranks fourth in terms of output among the Provinces primary industries. In 1980, some 5,200 fisherman operated vessels, and the processing industry employed 10,000. New Brunswick has been holding its share of Canadian North Atlantic landings at about 17 percent; although processed output has grown steadily. The Federal and Provincial governments have been pursuing a number of initiatives to support primary and processing activities related to fishing.

A priority opportunity for New Brunswick within the marine sciences relates to aquaculture. A recent statement by the Science Council of Canada, "Aquaculture: An Opportunity for Canadians" (March 1985), suggests that Canada has a potentially strong role to play in the rapidly evolving international aquaculture environment. New Brunswick also has a potentially important role to play given its combination of unique natural and research resources.

As noted in the Science Council's Statement, Aquaculture has become a viable activity in a number of nations around the world, among them China, Japan and Norway. Based on its review of the world aquaculture "industry" and Canada's resources, the Science Council has recommended that aquaculture be aggressively promoted in Canada, and has set an agenda for action which compliments New Brunswick's needs. These recommendations include establishment of lead agencies, collaborative projects with industry to addressing common technical problems, training programs, establishment of centers of excellence.

New Brunswick "edge" appears to be its strong competitive position to develop salmonid and trout aquaculture in the Bay of Fundy and shellfish, particularly mussels, along the East coast (where some six mussel farms have already been started). At present, the strongest competition to potential salmon and trout aquaculture development in New Brunswick is being posed by the Norwegians, which have already established a successful industry producing some 22,700 metric tons of salmon and trout in 1983 and with estimated yields exceeding 25,000 in 1984. The Norwegian aquaculture industry employed roughly 2,000 in 1984 on 400 farms. The species and cold water environment are akin to New Brunswick's aquaculture opportunities. However, New Brunswick is not alone in eying the coldwater salmon aquaculture opportunity--Scotland, Ireland, Iceland and the Faroe Islands are among the other countries which may become prospectively significant participants. Strong competition for shellfish farming is coming from within the Maritimes--Nova Scotia and Prince Edward Island--as well as beyond. The government of Nova Scotia has made a strong commitment to support development of its aquaculture and has capitalized on the concentration of expertise and facilities at Dalhousie University, NRC laboratories and other institutions.

In addition to its natural environment, New Brunswick has a number of research strengths upon which it can capitalize in pursuing aquaculture development. Several key institutions include:

- The Huntsman Marine Laboratory--established in 1969 through the joint efforts and support of a group of universities (UNB, UdeM, and others in and outside of the Province), the Provincial Department of Fisheries, and the Federal Department of Fisheries and Oceans, HML has pursued a tradition of field research, education, exchange and technology transfer in fisheries, biology and marine sciences. Its current staff is 25 with a 1984 budget of $1.3 million. Current research priorities include aquaculture, natural products chemistry, developmental biology, toxiocology and biotechnology, with a strong emphasis on aquaculture adopted as part of its current long range strategic plan. A proposed Aquaculture Center will focus government academic and private sector efforts in aquaculture research, training, and extension services.

- Biological Station, Department of Fisheries and Oceans--the Biological Station located at St. Andrews has a staff of 100 including 30 professional scientists specializing in fisheries management. The research activities underway include fish population management, development of fish farming methods, and forecasting changes in habitat. The St. Andrews Station is linked to larger DFO facilities in Halifax.

- Atlantic Salmon Research Institute--part of the Atlantic Salmon Federation, a non-profit organization, ASRI specializes in smolt and is involved in cooperative research programs in salmonid genetics and selective breeding. Through its research programs and the Federation, ASRI has established strong interactive ties to DFO, Huntsman, local seafarmers, and research institutes in Halifax, Woods Hole, Massachusetts and elsewhere.

- University of New Brunswick and University de Moncton--both have research and educational programs in the marine sciences.

- The Research and Productivity Council--RPC has staff dedicated to the marine sciences and aquaculture, which has worked closely with New Brunswick institutes and seafarmers as well as internationally.

Key research institutes outside New Brunswick which represent important sources for liaison include:

- Dalhousie University, Nova Scotia.
- National Research Council, Atlantic Research Laboratory, in Halifax, specializing in marine engineering.
- Center for Ocean Technology, DFO-Marine Fisheries Division, in Halifax.
- Other key resources in Nova Scotia.
- Other Canadian Resources (British Columbia?).
- Woodshole Ocenographic Institute, Massachusetts.
- Other U.S. institutes, including University of Washington Fisheries Research Institute, University of Alaska Fishery Industry Technology Center; Northwest and Alaska Fishery Center; Oregon Department of Fish and Wildlife Research and Development Section (Coastal Salmonid Program).

If New Brunswick is to pursue aquaculture opportunities, a number of key technical factors must be considered. Among these are:

- Supply of Seed Stock--a significant factor in salmon farming is the cost of rearing juvenile salmon, or smolts. Salmonid enhancement programs have been pursued most frequently at government laboratory facilities although other research facilities have pursued smolt research also (Atlantic Salmon Research Institute). The Science Council Statement indicates that the supply of smolt with genetic strains suitable for farming has been a limiting factor in salmon farming in Europe, which may represent an opportunity for Canada. Further, the Council suggests that some salmonid enhancement programs should be placed under contract managed by the private sector. The St. Andrews area is in a good position to pursue this kind of arrangement with its concentration of smolt research facilities and the recent arrival of Sea Farms, Ltd.

- Feed Stock and Methods--finfish aquaculture requires the feeding of artificially formulated diets to fish in enclosed cages, tanks, ponds and raceways. More so than for shellfish cultivation, the cost of fish feed is an important factor of production for salmon and trout farming. Nutrition is a critical aspect of feed technology in which substantial gains are needed. In addition, technology improvements are needed to cages and holding tanks.

- Health and Disease Control--one of the most significant factors contributing to the risk associated with aquaculture, disease control research is one of the the more important priorities to address in support of developing an aquaculture industry.

- Legal Standards, Regulatory Controls and Management Practices--current fishery regulations in place in New Brunswick deal with wild fisheries and are inappropriate to address the legal and regulatory needs of cultured fisheries. Nova Scotia has established regulations to protect and allow for sound environmental management of cultured fisheries. This is an important priority within New Brunswick so that this young industry can develop in a well-managed and orderly environment, with clear "operating" ruler and guidelines.

Finally, an important building block for future aquaculture is the Canada-New Brunswick Subsidiary Agreement on Fisheries Development (August 27, 1984), which has provisions in it committing $7.0 million ($3.5 million contributed by the Federal Government and the remainder by the Province) to "resource development". The agreement specifies three targets for these funds: a Salmonid culture program; molusk use development and habitat enhancement.

It is based upon this background that the following initiatives are recommended.

OBJECTIVE

The objective of New Brunswick's aquaculture and marine sciences initiative is to promote cold water species aquaculture development (salmon, trout and other species), to promote shellfish farming opportunities, (particularly mussels), to promote extension of these activities to New Brunswick regions supporting more traditional fishing activities, and to provide a framework for promotion of longer term aquaculture opportunities related to other species (e.g., scallops, turbot and other species). To accomplish this, a strong combined, and effectively coordinated effort is required by both the public and private sector, with substantially increased participation by the private sector to provide a realistic market perspective.

ACTIONS

The New Brunswick aquaculture and marine science community should pursue a series of actions to capitalize on its unique natural resource and concentration of specialized research expertise, taking advantage of the existing resources committed by the existing Federal Provincial subsidiary agreement and the strong development climate promoted by the Science Council of Canada Statement on Aquaculture. A first priority will be to establish:

- o Aquaculture and Fisheries Development Council--A critical void which must be filled if New Brunswick is to effectively compete in the rapidly growing and increasingly competitive aquaculture industry relates to leadership. While there are numerous public and private "players" apparently dedicated to a common goal, there is the need for a single leadership voice to set priority directions, marshall and coordinate resources, and insure commitment and follow-through. This "council" should have its governing board, a majority of representation from the private sector (including participating larger firms, entrepreneurial seafarmers, and private, non-profit research institutes) and from the key public research institutes and agencies. This council should not take the form of another "agency" rather should be vested with decision-making authority to allocate a portion of the public funds dedicated to aquaculture development and to set priorities for jointly funded private-public research, pilot or demonstration projects. The Council should have a lean staff: an executive director, or two co-directors (with the combined characteristics of experience in the field, wisdom, clout, an ability to command respect within the fisheries and aquaculture community, and the drive to "make things happen"), and one or two support staff. Each represented agency, institute and business should contribute the limited operating budget of the council.

On the near-term agenda of this leadership council are the following steps to clearly dilineate, reinforce and promote its competitive edge in coldwater specie and selected shellfish aquaculture:

- o Maintain and Expand as necessary Basic and Applied Research Budgets--If New Brunswick's research institutes are to maintain and strengthen their "edge" to pursue aquaculture development, funding for basic and applied research programs must be maintained with a focus on the technologies most important to New Brunswick's future opportunities. Specifically, the recent trend of declining funding commitment to aquaculture related research at the DFO Biological Station must be reversed. Building on the station's remaining expertise, this must be revitalized to become a leading research institution. Overall, R&D commitments must insure that aquaculture and related technologies "work" better, and that basic research is continued at a level of support necessary to spawn new innovations.

- Insure the Smolt Resource Advantage--To maintain this edge over the rapidly growing European salmon and trout farmers the New Brunswick aquaculture community must insure that the quality and supply of smolt production is maintained within the Province. Private sector endeavors must be aggressively supported in this regard, including Sea Farm's activities and other potential private contract arrangements to manage smolt enhancement programs.

- Maintain and Strengthen Linkages to Aquaculture Research Expertise outside New Brunswick--This effort is vital to monitoring research and aquaculture technology development both to effectively capitalize on them for the New Brunswick community and to keep track of the changing competitive environment. New Brunswick's limited resources require that where appropriate existing technology developed by "outsiders" be targeted and adapted to the needs of New Brunswick's community. An important example is in the engineering aspects of aquaculture where the NRC's and other facilities in Halifax have a noted strength. In other instances, this monitoring activity should provide important signals to the research community and aquaculture industry in New Brunswick regarding its competitive position and where steps may be required to strengthen it.

- Joint Demonstration Projects--The leadership council should consider on an ongoing basis potential research projects, the application of which provide common benefit to the New Brunswick aquaculture community. These joint projects should be pursued on the basis of matching funding by the private and public sector. A mechanisms for private sector input should be considered which scales contributions relative to the size measure by sales, employment or some other indicators of private participants. Thus, entrepreneurs who would benefit from the research would take a "share" of the funding responsibility, but smaller relative to larger participants. One suggested demonstration or joint research project is in the area of health and disease control. In this or other areas, a project proposal should be assembled identify a program of work, anticipated results, participants, cost and timing. This should be reviewed for approval by the leadership council.

- Marine Science and Aquaculture Extension Service--Building upon the current activities of the research institutions in St. Andrews and elsewhere in the Province and on the proposed "extension activities" associated with HML's Aquaculture Center, a high profile extension service should be established. An overall mandate of this service will be to facilitate transfer of technology from research institutions to business and transfer opportunities to the more traditional fishing industry, particularly along the Northeast Coast. (In Norway, half of today's salmon farmers were at one time former fisherman or fish processing employees--in New Brunswick, this could also have important implications.) The service should be modeled in a fashion similar to the U.S. agricultural extension services. It should draw its staff from HML, DFO, and other institutions and be funded by government. The extension service staff should maintain a very visible field presence in the Bay of Fundy and East Coast regions. The service staff should actively reach out to aquaculture and fisheries businesses regularly, securing their trust and confidence as a reliable and qualified first contact to assist directly or access appropriate assistance in a variety of technical needs. An important aspect of this service will be quick and timely response to questions or requests for assistance by businesses. Among the areas of assistance in which the marine science and aquaculture extension service should specialize are:

    - Direct technical assistance to facilitate transfer of technology, expertise and practical application between aquaculture and marine science research institutes and businesses.

    - Information clearing house, to provide improved access for businesses to information on relevant research, technical issues, and supporting information (e.g., market trends, transportation and shipping methods, etc.).

    - Marketing and export assistance, to assist fish and shellfish farmers and related businesses in more adequately considering new markets for their products and services. Already the Norwegians are shipping farmed salmon by air freight to markets beyond the European community--among them New England, the state of Washington, and Tokyo. This assistance will be vital if the New Brunswick industry is to have a change at cracking Norway's dominant market share--currently set at around 85 percent of farmed salmon, with Scotland holding on to the Number 2 position. To be effective, the extension service must be capable of both providing some level of marketing and export assistance itself, and also draw upon outside expertise as necessary.

- Referral assistance to sources of financial support. Working closely with the industrial development commissioners and the Department of Commerce and Development, extension service staff should provide quick referral to appropriate sources of public and private finance, and should provide access to the necessary technical and financial expertise to expedite evaluation and approval of requests for financial assistance. This is particularly important to this very young industry with which many financial institutions have little familiarity.

o Legal and Regulatory Guidelines--As noted above, a priority need to ensure the orderly development of cultured fisheries opportunities relates to the establishment of regulatory controls, standards, and other legal guidelines. At present, the New Brunswick aquaculture community is without "rules and guidelines" of its own, yet is competing with an industry in Nova Scotia and elsewhere in which appropriate guidelines have been adopted. The leadership council should assume responsibility for drafting proposed regulations and legislation for aquaculture, drawing upon Nova Scotia's experience, national and international experience and commissioning necessary level and technical support. The proposed legislation should be put forth to the appropriate Provincial bodies for review and approval. To ensure swift action, the leadership council may have to undertake a campaign to enlist broad support across the Province and should be prepared to do so.

RESPONSIBILITY

The Marine and Aquaculture Development Council should assume leadership responsibility for these efforts with increased participation by the private sector on the board and in funding specific applied research projects, as outlined above. Leading responsibility for basic and research, extension service activities should be maintained at HML, DFO and by the New Brunswick Department of Fisheries.

RESOURCES

As noted above, the commitments outlined in the Federal Provincial Subsidiary agreement should be leveraged to elicit private sector participation and funding in selected research projects and should be targeted to priority areas in basic research, extension and supporting services at research institution.

ATTACHMENT A.3

BACKGROUND IN NEW BRUNSWICK'S FISHERIES INDUSTRIES

As noted in "Meeting the Challenge of the Eighties," the fisheries sector ranks fourth in terms of output among New Brunswick's primary industries. Although landings experienced wide fluctuations in the last twenty years, landed value showed unprecedented growth during that period, increasing from $7.7 million in 1961 to $54 million in 1979.

In 1980, roughly 5,200 fishermen operating 3,100 vessels landed 107,161 tonnes of various species valued at $48.7 million. These landings were processed in 130 plants and had an estimated market value of $281 million. The handling and processing sector employed in value added in the secondary sector. This reflects the importance to the Province of the supplemental supplies of tuna, lobster, herring and groundfish brought into the Province for processing.

With regard to employment in the sector, a decline of about 13 percent was experienced over the last 20 years in the harvesting area. It is not expected that the number of fishermen will increase in the next 10 years due to a tightening in the availability of licenses and the federal government's buy-back program involving salmon and lobster licenses. Since some 50 percent of fishermen land about 85 percent of the fish the reduction in the number of fishermen has had only a minor impact on landings. In contrast, employment in the processing sector has increased by 66 percent in the last 20 years, as a result of increased marketing efforts and an increased consumer appreciation of the nutritive value of fish.

Exports of New Brunswick's fishery products have shown healthy gains over the last decade, registering an increase of 246 percent. This was due, in part, to an aggressive program, of product development, market intelligence, trade missions and seafood promotion. The U.S.A. remains the largest export market accounting for 64 percent of our exports. It is followed by Europe (18.2 percent), Central America (8.2 percent), Asia (4.4 percent) and Oceania (3.4 percent).

Source: Province of New Brunswick, "Meeting the Challenge of the Eighties", undated.

APPENDIX A.4

COMPUTER MICROELECTRONICS, AUTOMATION, AND MANAGEMENT TECHNOLOGIES

COMPUTER, MICROELECTRONICS, AND AUTOMATION TECHNOLOGIES: APPLICATIONS IN MANUFACTURING

RATIONALE

New Brunswick's manufacturing industries currently represent approximately 17 percent of employment in the Provincial economy. Nearly two-thirds of manufacturing employment is directly related to New Brunswick's natural resource activities--6 percent in food and fish processing, and 4 percent in paper, furniture and other forestry related products. The remaining one third includes such activities as machining and metal working, minerals processing, shipbuilding, and a number of other activities. Additional background on New Brunswick's manufacturing sectors is summarized in Attachment A.

To strengthen and broaden its economic base and provide for increased non-seasonal employment opportunities, New Brunswick must increasingly diversify into more value-added products and services related to its natural resource base and into non-resourced-based manufacturing. A strengthened technology base with improved access in selected manufacturing technologies will be essential to strengthening the competitiveness of existing manufacturing activities and to achieving the objective of diversification. Technology-related initiatives targeted to New Brunswick's natural resource sectors are addressed under separate memoranda: forestry-related technology initiatives; aquaculture and marine sciences technology initiatives; computer, microelectronics and automation technologies and minerals technology initiatives. This discussion addresses priority technologies related to manufacturing and supporting activities, among them.

New Brunswick's Manufacturing Technology Resources and Needs

New Brunswick currently has several key resources upon which further manufacturing technology initiatives can be built upon.

Among the principal strengths are:

- Manufacturing Technology Center (MTC). Initially funded by the New Brunswick Department of Commerce and Development, MTC was founded in 1983. With manufacturing technology equipment and expertise at RPC-University of New Brunswick and six other community college locations throughout the Province, MTC has been pursing the objectives of technical training, technical assistance, and technology transfer.

- Center for Applications and Development of Microelectronics Inc. (CADMI). Initially funded by the federal government, CADMI has the objective of providing technical assistance in the application of microelectronics technology in industry. CADMI has facilities and expertise at University of New Brunswick and Universite de Moncton.

- University of New Brunswick Computer Sciences Department. Computer Sciences at UNB is recognized as a strength in its field within the Maritimes and throughout Canada. The department offers the option of a co-operative education program to students, providing access to practical job opportunities during the course of education.

- Information System and Engineering Consulting firms. The Province has a number of information system service and consulting firms, including several larger firms with national and international markets.

- University of New Brunswick Engineering School. Also recognized as a strength, UNB's engineering disciplines are an important resource to be more effectively capitalized upon in the Province.

- Research and Productivity Council. RPC is an independent nonprofit organization which has the mandate of technology transfer and conducts research contracts and technical assistance projects in a number of manufacturing sectors key to New Brunswick economy.

These and other technology resources need to be more effectively utilized to address the needs of manufacturing and support activities. Our interviews with companies throughout the Province suggest that there is a mixed awareness of these resources--some firms have had positive direct experience while others are unaware of or have confused images of the potential implications of these resources for their own operations. In some cases, more effective promotion of the expertise, facilities and overall capabilities of these technology resources is needed to convince New Brunswick companies that "there is something in it for them".

Consideration of the Province's existing and potential business opportunities suggest there is the need for the following strengthened or newly established initiatives:

- Computer Aided Automation and Other Manufacturing Technologies--building on the capabilities of MTC, CADMI and RPC and UNB departments, these resources need to be more aggressively promoted and more effectively managed and utilized to respond to priority needs of the private sector.

- Management Information Technologies--building on the capabilities of private companies engaged in this activity and the expertise of technology institution, an effort is needed to marshall these resources into a collective delivery system to promote and disseminate these services. These technologies are increasingly important to businesses in inventory control, production flow management, marketing and a variety of other functions.

- Systems Engineering and Integration--building upon the strengths of UNB's Engineering Department and engineering consultants in the Province, systems engineering and integration is important to packaging the appropriate technologies to best fit a company's individual needs and opportunities.

An overall requirement associated with the above initiatives relates to a more prominent private sector role in providing strategic direction; activity management, in some cases; and market-driven incentive associated with pursuit of specific projects or activities.

Manufacturing-Related Technology Initiatives Outside of New Brunswick

New Brunswick should consider its competitive position to pursue manufacturing related technology opportunities given the needs associated with existing and potential manufacturing activities and the strengths of associated technology research institutions. This must be considered within the context of competitive research initiatives and expertise in other provinces and locales outside of Canada. The other "initiatives" or activities should also be considered in terms of potential assistance to New Brunswick, if appropriate linkages are established. Among these centers of activity are:

- Manitoba Research Council;
- Alberta Microelectronics Center;
- Canadian Institute of Metalworking;
- Massachusetts Institute of Technology Laboratory for Manufacturing and Productivity;
- Microelectronics Center of North Carolina; and
- Others.

These and other centers such as those described in Attachment B represent both a potential source of expertise and "lessons learned" and potential competitors, to the extent they may hold a leadership edge in a specific technology area.

Based upon this background, the following initiatives are recommended.

OBJECTIVE

The objective of these initiatives are to promote more efficient utilization of technologies in manufacturing to enhance the competitiveness of New Brunswick firms and to stimulate diversification opportunities. To achieve this objective, a strong participation by the private sector will be required.

ACTIONS

An overriding priority associated with manufacturing technology initiatives is to address the need for an umbrella leadership group to provide strong direction, and ensure effective management of and coordination among initiatives. An initial action, then, is to establish:

- Microelectronics, Automation and Computer Technologies Council, or similar leadership and oversight group. This council should be established headed by a single board of directors, in effect, drawing from the two existing boards of CADMI and MTC. The private sector should hold a majority of seats on the Board. The role of the Board should be to provide overall direction and oversight of the activities described below to ensure that they address the most promising opportunities and priority needs, including specific basic research projects, in an effective manner. This Board, with its clout, should marshall the involvement and contributions of other institutions and businesses throughout New Brunswick, as appropriate. Reporting to the Board, an executive director should be appointed to carry out Board decisions, to coordinate the various activities described below, and to ensure effective management of the resources and facilities. The executive director should work closely with representatives of the New Brunswick chapter of the Canadian Manufacturers Association and other key industry groups to promote the resources and services of these initiatives and to monitor progress. The executive director should be supported by one or two staff persons--overall a lean operation rather than a new "agency".

This umbrella group should oversee four priority activities, each designed to interact directly with and serve the needs of the private sector, as illustrated in Figure 1. These activities are:

- Manufacturing Technology Center. Building on existing facilities, expertise, and recent accomplishments, MTC should continue to pursue private sector support and joint projects/activities in training, technical assistance and prototype development. RPC, with its technology transfer mandate, should play a strong role in delivering the assistance and transfer services. Funding for MTC should be increasingly provided by the private sector, through contracting of services and levying user fees to companies seeking to use MTC facilities or staff. Efforts should be made to improve the overall efficient utilization and management of MTC facilities to address the concern that some MTC facilities are "overbooked" while others are underutilized. Local MTC staff should undertake promotional efforts to reach out in their communities to generate awareness among local business and to ensure that their activities are tailored to local needs. Some are already doing so, working with Industrial Development Commissioners.

- Centre for Applications and Development of Microelectronics. CADMI should continue to build upon its expertise and resources, and should sharpen its focus in providing technical assistance to firms applying microelectronics technology. CADMI staff should be dedicated full-time to this objective, and should undertake increased efforts to promote their resources. As with MTC, this has begun to occur in some instances with the assistance of the industrial development commissioners. The Board of Directors (noted above) should provide strong direction on the evolution of CADMI's activities. In addition, the activities must be sufficiently attractive to elicit the private sector support that will be necessary for CADMI to become self sufficient at the end of its five-year mandate from DRIE.

- Management Information Systems. A new initiative should be undertaken to provide management information systems, data base management, and related services to manufacturing and other firms in New Brunswick. This initiative should be in the form of a joint venture by private firms with MIS expertise who will provide these services on a contract or fee basis. Among the firms and groups which might be involved are New Brunswick Telephone (with extensive communications and MIS capability), specialty consulting firms and individual consultants, for example from UNB's Computer Sciences Department. Among the services which could be provided are systems packaging, training, installation of turn-key systems, needs analysis, and general technical assistance.

- Systems Engineering and Integration. Also a new initiative should be undertake in systems engineering and integration. This also should be in the form of a joint venture by interested private engineering consulting firms and individuals, for example, UNB engineering professors. Systems services should be provided on a fee basis, and could include process systems packaging; integration systems linking MIS with process, production, quality control and other functions, needs analysis, among others.

RESPONSIBILITY

The new Board of Directors (Microelectronics, Automation and Computer Technologies Council, or other designated group) should provide leadership and oversight responsibility, and should provide the direction necessary to ensure that these activities are "market driven".

RESOURCES

Resources beyond those already committed to MTC, CADMI should be as follows:

- Board and executive director/core staff expenses should be jointly funded by the private and government sectors.
- Joint research projects at CADMI or MTC should be supported by matching funds (private-public) in the case of more "basic projects" and by contract fees, in the case of applied research.
- Other services should be increasingly funded by user fees and private sector contracts.

ATTACHMENT A.4

NEW BRUNSWICK'S MANUFACTURING SECTOR

As outlined in "Meeting the Challenge of the Eighties" (Province of New Brunswick, undated), the New Brunswick manufacturing sector consists of more than 1,250 firms directly employing 37,000 persons according to the Statistics Canada Labour Force Survey. The annual provincial survey of manufacturers, however, indicates that employment ranges between approximately 34,000 to 50,000 depending on the season of the year. The value of shipments from these firms was almost 3.5 billion dollars in 1980. In addition, these firms account for 16 percent of both New Brunswick's Real Domestic Product (R.D.P.) and employment.

Manufacturing is vital to the provincial economy, not only due to its own employment and output but also due to its high impact on the other economic sectors. Processing is of vital importance to the respective harvesting and resource extraction activities.

There are manufacturing activities in all regions of the Province and consequently this sector makes a significant contribution to balanced regional development. Small firms dominate this sector and form an important target for provincial programs. Over eight hundred firms employ fewer than 25 employees.

Ninety percent of all manufacturing firms are owned by New Brunswickers. In fact, only 4 percent of the Province's manufacturing firms representing 8 percent of the employment is foreign owned. In comparison, it is estimated that 58 percent of all manufacturing in Canada was foreign controlled. Consequently, foreign investment, in addition to local investment, is encouraged because it is not an issue in New Brunswick, as in Canada.

Every major manufacturing group is represented in the Province. The Province's heavy reliance on forest, agriculture and fish related products remains. Together, these products constitute roughly 60 percent of the value added in New Brunswick manufacturing. Other major industry groups represented include rubber and plastics, leather, textiles, clothing, printing and publishing, metal fabricating, primary equipment, electrical products, non-metallic minerals, petroleum and coal, chemical and miscellaneous manufacturing. Since some primary resources are approaching full utilization, such as softwood and groundfish, diversification of the industrial base away from the traditional primary products will be essential for future growth.

APPENDIX A.5

PRIORITY SUPPORT INITIATIVES: START-UP AND SEED CAPITAL, VENTURE CAPITAL PROGRAM, AND ENTERPRISE AND PRODUCT DEVELOPMENT CORPORATION

A WRITE-UP OF THE FOLLOWING INITIATIVES:
THE START-UP ASSISTANCE AND SEED CAPITAL PROGRAM;
THE EXPANDED VENTURE CAPITAL PROGRAM; AND
THE NEW BRUNSWICK ENTERPRISE AND PRODUCT DEVELOPMENT CORPORATION

BACKGROUND

Home-grown new product businesses have made an important contribution to the longer-term diversification of many regional and local economies while enhancing employment opportunities. In the Province of New Brunswick there have been relatively few initiatives to develop and exploit new product concepts or new technologies, either by private individuals or established companies. Moreover, New Brunswick innovators have, for the large part, had to look outside the Province and, often, the country, to find financial support to further develop and commercialize new product concepts and technologies. As a result, the Province has foregone the potential economic activity that might arise out of new concept and technology developments. This experience is not unique to New Brunswick. Other small provinces and states in North America are in similar situations and are examining what has to be done to provide the environment and infrastructure necessary to encourage and support new venture in their jurisdictions.

During the course of the strategy planning process, a number of reasons have been put forward to account for the relatively few new products/technology ventures in the Province. At the core of the problem are the Province's somewhat limited science and technological capabilities and the dearth of technology engines from which one would normally expect spin-off ventures to occur. Equally important, the environment in New Brunswick is not particularly encouraging of entrepreneurship; nor is the support infrastructure in place to provide the innovator/entrepreneur with the technical, business and financial support services critical to launching a new product or venture.

Despite the host of federal and provincial financial assistance programs, government officials have pointed to their limited ability to respond to the need of new ventures in the product development and production start-up phases, particularly in those situations where the sponsors are either the inventor or a small businessman. Important problems identified are:

- The limited capability of financial assistance programs, federal or provincial, to deal with the new venture start-up situation. There are a few examples where SIFAP and IRDB programs have been used to support new high-tech ventures in the Province -- these examples should be drawn upon in support of future ventures.

- The discomfort of development agencies in providing public funds to support new product ventures which are perceived as high risk. There are two aspects to this problem: one relates to the conservative nature of civil servants -- due in part to the pressure to be accountable to the public in dealing with public funds; the second relates to the lack of understanding with the technology involved, the potential markets for the product or process and more generally the management of technology-related businesses.

- The limited scope of governments' technical assistance programs, particularly in relation to the needs of the innovator/entrepreneur in a high-tech venture.

Another factor relates to the reluctance of venture capital groups to invest in high-risk ventures, particularly those which involve technologies or product applications which are not readily understood. Reference has been made to the Province's Venture Capital Support Program (VCSP) and its lack of success to date in stimulating the formation of private venture capital pools in the Province. It has been argued that there is a need for additional incentives at the provincial level to encourage private investors to invest in New Brunswick companies. The Province should consider incentives such as those apparently successful in Quebec (QSSP and SODEQ initiatives), and Ontario (SBDC program) as well as similar initiatives in Saskatchewan, Alberta and British Columbia. The May 23rd federal budget has introduced a number of measures which, on paper, should stimulate private sector investment in small businesses, i.e.:

- Tax-free exemption on the first $500,000 of capital gains;

- Small business investment corporation tax credits for investors;

- Allowance to use up to 50 percent of individuals RRSP's to invest in Canadian controlled private businesses.

There has not been the opportunity, as yet, to assess the impact of these measures.

It is also apparent that financial institutions in the Province are also risk adverse and wish to have their loans covered by collateral and/or government loan guarantees. In point, they look to governments as well as the project sponsors to put up risk capital.

We are not in a position to estimate with any confidence how many new technology ventures might be forthcoming because of the various recommendations in this report; but we do believe that it is important to provide the environment and infrastructure necessary to encourage and support new product development and new commercial ventures. To this end, we recommend the following initiatives.

Start-Up Assistance and Seed Capital Program

The corporate tax regime governing New Brunswick manufacturing and processing companies engaged in research and development is clearly attractive, particularly if firms are small, Canadian-controlled and profitable:

- For Canadian-controlled small businesses, federal and provincial corporate income tax rates are 10 and 9 percent respectively; (the provincial tax is temporarily suspended), and the tax rates for other manufacturers and processors are 30 percent for the federal government and 14 percent for the Province tax. (The May 23rd federal budget has added a 5 percent surtax on federal income tax for the period July 6, 1985 to July 1, 1986.)
- Capital cost allowances permit a two-year accelerated depreciation of capital investments and a 100 percent write-off of all research and development expenditures plus an uplift of 50 percent on the increase in R&D expenditures over the average of the previous three years.
- Investment tax credits are permitted research and development, ranging from 30 to 50 percent (in the latter areas under the Regional Development Incentives Act) on the total of current and capital R&D expenditures irrespective of any grants received.

The system of investment tax credits for research and development activity in particular has a major impact on reducing the after-tax cost of an investment and reducing and, most importantly, postponing tax on operating income. The May 23rd federal budget has addressed the situation that small Canadian-controlled companies not in a position to use their R&D tax credits are now able to claim a full refund from the government up to a limit of $2 million a year (previously 40 percent).

Officials of the principal federal and provincial economic development agencies have reported upon their difficulties in supporting the entrepreneur, innovators or small companies in financing the product development and start-up phases of new ventures. Through its IRDP-Innovation Program, DRIE allows for grants of up to 50 percent of the cost of the development of new products in Tier 3 and 4 regions (these encompass most of New Brunswick), a vehicle through which it can provide strong support to product development. In the past, however, it has been the larger, well-established companies that have benefited from the IRDP-Innovation programs. NRC's IRAP programs, administered by RPC in the New Brunswick, have apparently had a positive reception by New Brunswick companies, large and small; but the level of financial assistance available through IRAP is relatively low. The SIFAP program of the Province's Department of Commerce and

Development has also been popular with small businesses; but it is geared more to employment creation through facilitating the expansion of established businesses in the more traditional sectors of the provincial economy, although it has provided support to a few new high-tech companies in the start-up phase of the venture. SIFAP also is limited by a relatively low ceiling on eligible financing.

The recommendations presented below should be considered in conjunction with the recommended need for the Venture Capital Support Program and the New Brunswick Enterprise and Product Development Corporation (EPDC), both discussed below. In putting forth these recommendations, we recognize that the federal and provincial agencies involved will need to make sure that any changes to existing programs or new initiatives be consistent with, and complementary to each other, with other financial assistance programs in place and the fiscal regime.

The recommendations are:

1. The IRAP and IRDP-Innovation programs should be reviewed with the objective of finding means to better support product development, from concept to development and refinement of prototypes.

2. The IRDP-Establishment program should be refocused in order to be more responsive to the production start-up requirements of new product ventures.

3. The SIFAP grant program should be available to new product ventures and supplemented with a new product venture assistance loan program, providing five-year loans of up to 500,000 dollars at the government borrowing rate.

An Expanded Venture Capital Support Program

We understand that the Province's Venture Capital Support Program (VCSP) is to be reviewed with the objective of increasing its effectiveness in stimulating the formation of private venture capital pools in the Province. We recommend that the VCSP should be restructured along the lines of the moderately successful Ontario SBDC program which Alberta, Saskatchewan and British Columbia have subsequently adopted with minor modifications. The success of the Ontario program can be attributed to three factors: the attractiveness to investors of the incentive of a government grant or tax credit equal to 30 percent of the investor's equity investment in a Small Business Development Corporation (SBDC); the need for the SBDC to find suitable investments within a specified time period; and the range of investment opportunities in the Province of Ontario.

The objective of a revised VCSP should be to stimulate the growth of small businesses through the concepts of venture capitalism and government assistance.

The revised VCSP should have the following elements:

1. An investor or group of investors could establish a venture capital fund under the auspices of the VCSP with a minimum of $25,000 in equity capital on registration under the VCSP.

2. Investors would receive a government grant (to individuals) or tax credit (to corporations) equal to 30 percent of their investment.

3. The total equity capital of a VCSP company would be limited to $5 million.

4. A percentage of the equity capital, equal to the government contribution, must be deposited in a trust fund. Approval for withdrawal is given when the VCSP company invests in an eligible small business at which time 3/7ths of the investment can be withdrawn from the trust.

5. The VCSP must purchase new equity shares (voting) to a limit of 49 percent (two or more unassociated SBDC's can own up to 60 percent). VCSP financing of eligible small business should be limited to $2.5 million.

6. By the end of the first year, a VCSP company must have a minimum of $50,000 in equity capital of which 40 percent must be invested by the end of the first year and 70 percent by the end of the second year.

7. An eligible company would be investing in the following areas:

   - Manufacturing or processing
   - Maintenance or servicing
   - Research and development
   - Software development
   - Aquaculture

   and meets these criteria:

   - Canadian-controlled
   - Less than 150 employees
   - Pays more than 75 percent of its wages and salaries in New Brunswick
   - At arm's length from the VCSP.

New Brunswick Enterprise and Product Development Corporation

It is proposed that a New Brunswick Enterprise and Product Development Corporation (EPDC) be established to serve as the focal point for marshalling public, institutional and private sector resources to support entrepreneurs, innovators and companies in the development and commercialization of new technologies and products. Reporting to the proposed New Brunswick Technology Council (see Chapter III), the EPDC will be give the mandate to:

1. Evaluate new technological innovations and products as to their technical feasibility and merit and economic potential;

2. Advise and guide innovators, entrepreneurs and companies to finding required technical assistance;

3. Advise on technological trends and competing products/technologies;

4. Advise and guide innovators, entrepreneurs and companies on available government financial and technical assistance programs;

5. Advise and guide innovators, entrepreneurs and companies on developing business plans and marketing strategies;

6. Interface with a new New Brunswick Enterprise Forum which will be set-up to provide to venture sponsors, advice and guidance on the financing, management and marketing aspects of the proposed venture;

7. Interface with investment groups and financial entities and expose to them new technology investment opportunities, i.e., the matchmaking function; and

8. Identify to the New Brunswick Technology Council candidates for the Technology Demonstration Program.

The EPDC will be structured along the lines of the Saskatchewan New Venture Assistance Corporation with a Director at the head supported by Vice-Presidents of Finance and Marketing. These should be experienced senior-level individuals who have had business experience in the high-tech field. They should be supported by civil servants seconded from the Department of Commerce and Development and DRIE who will provide information on packaging government programs as well as guidance through the government network.

An ad hoc technology advisory group should be set up to assist in the technical evaluation of proposals and provide some perspective on their merits given their knowledge of ongoing research elsewhere and technological trends. This group will also provide recommendations on whether further evaluations are required and by whom this is best done. It will be necessary that the EPDC have a budget for such consulting services.

Associated with the EPDC will be a New Brunswick Enterprise Forum, established along the lines of the MIT Enterprise Forum, set-up to advise and provide guidance to the innovators and entrepreneurs on the business aspects of the proposed venture. Some 19 such forums exist in North America today. The forum typically involves regular meetings of a rotating panel of advisors (with expertise in venture capital and other finance, industry and technology) at which innovators/entrepreneurs present their ideas or business plans for critique. Such enterprise forums have made important contributions to the successful start-up of new ventures in other jurisdictions and the New Brunswick business community should be asked to make a similar contribution of their time and experience.

We recommend that the EPDC refrain from advocating projects either to government funding agencies or to the financial community. Care must be taken that the EPDC present an arms-length objective evaluation of any new product venture, carefully qualifying any technical or business concerns and where the project might be at risk.

APPENDIX B

ECONOMIC DEVELOPMENT CONTEXT

APPENDIX B

ECONOMIC DEVELOPMENT CONTEXT

The economic profile of New Brunswick presented in this Appendix is divided into three sections:

- Overview of the structure and performance,
- Description of key industries--agriculture, fishing, mining, manufacturing and forestry; and
- Analysis of the strengths and weaknesses.

The Appendix is based on information gathered from a review of numerous Provincial and Federal government agency documents and from a series of panel discussions conducted throughout New Brunswick during November and December, 1984.

The labor force of New Brunswick increased from 205,000 to 289,000 from 1971 to 1981, an annual rate of 3.5 percent. This increase is shown in Figure B-1. Two major factors accounted for this increase: entry of the "baby boom" generation and women into the labor force. The pace of labor force expansion outstripped the ability of the economy to create new jobs. Hence the unemployment rate almost doubled in the decade, to over 11 percent. Since 1981, unemployment has continued to rise; in 1984, the average rate was 14.9 percent; the most recent rate for May 1985 was 15.5 percent, seasonally adjusted to 15.2 percent.

Figure B-2 shows the breakdown of employment by major employment sector for the Province as a whole for 1981. 1981 is the most recent year for which complete employment statistics are available from Statistics Canada.

The dominance of the non-manufacturing sector in the New Brunswick economy is evident. The government and service sector provided employment for 68 percent of the labor force, approximately the same percentage as the equivalent figure for Canada as a whole.

Table B-1 details a breakdown of employment in major industrial sectors by county. The manufacturing sector accounts for 16.9 percent of the Province's employment, compared to 19.2 percent for Canada. Employment in New Brunswick is more concentrated in the primary industries of agriculture, forestry, fishing and mining than the national average, and accounts for 8.1 percent of the labor force compared with 7.1 percent nationally. The significance of primary products to the Province's economy is evident in Table B-2. This table compounds the employment figures for each primary industry with those for manufacturing industries with which they are directly associated. The structure of the primary and manufacturing employment in each county is shown in Figure B-3, and the proportion of total county employment made up by these sectors is shown in Figure B-4.

The geographical distribution of industries across the Province is uneven as is shown in Figure B-5.. Almost two-thirds of the Province's total agriculturally related employment is located in only five counties: Victoria, Carleton, King, Westmorland and Gloucester. Four counties -- Gloucester, Charlotte, Westmorland and Kent -- account for more than 85 percent of employment in the fishing and fish processing industries. Two counties -- Northumberland and Gloucester -- account for 72 percent of mining and primary metal employment. With the commencement of potash mining in the Sussex area the importance of mining has increased considerably in Kings County. Over 50 percent of New Brunswick's total forestry employment is located in four counties Northumberland, Restigouche, York and Madawaska. Three counties -- St. John, Westmorland and Gloucester -- account for more than half of all employment in manufacturing.

Location coefficients for industries and counties in New Brunswick are presented in Table B-3. If the location coefficient is greater than one, the economy of the county is more dependent on that particular industry than the New Brunswick economy as a whole. If less than one, the industry is less represented in that county's economy. Table B-2 shows that Carleton, Kings and Victoria are all more than four times as dependent on agriculture than New Brunswick as a whole. Charlotte and Kent are both five times as dependent on fishing; Gloucester, five times as dependent on mining; and Northumberland, three times as dependent on forestry.

As shown in Table B-4 and Figure B-6, the manufacturing sector in New Brunswick is dominated by large firms. Almost half of the Province's average 41,000 manufacturing jobs are within the 54 firms with more than 200 employees. In contrast, the 920 small establishments account for 14 percent of all manufacturing jobs. The distribution of employment across size categories varies by industry. For example, 57 percent of the 12,600 people employed in the food and beverage industry work in 23 establishments with more than 200 employees; only 10 percent work in 164 establishments with less than 25 employees. A more highly skewed pattern exists in the paper industry, where 89 percent of the 5,700 people manufacturing paper work in the nine firms with more than 200 people, and less than 1 percent work in the establishments with less than 25 people. In contrast, one-quarter of all people engaged in manufacturing wood products work in the 199 establishments with less than 25 employees.

New Brunswick resource-based sectors are relatively mature and sensitive to international competition. The 3.5 percent average growth in New Brunswick's overall level of employment between 1970 and 1980 varied according to industry. Manufacturing employment exhibited little growth during this period. Wood related industries - wood products, furniture, and paper -- performed relatively poorly, and employment dropped by roughly 1 percent per year between 1978 and 1980. (See Table B-5). Employment in the food and beverage industry climbed at a rate of 2 percent annually, from a base of 12,900 in 1978 to 14,600 in 1984. The primary metal, and rubber and plastics industries grew by 8 percent and 10 percent respectively. However, given the initial employment base of these industries, their growth added only 463 jobs in New Brunswick over the last six years.

The growth that has occurred should be viewed within the context of another aspect of the Provincial economy, notably sharp seasonal fluctuations in employment. As show in Table B-6, even manufacturing employment, on the whole less sensitive to changes in the seasons than agriculture, forestry and fishing, varied by more than 27 percent in 1978 and 52 percent in 1981. Figure B-7 shows the seasonal fluctuations. The largest single industry -- food and beverage -- exhibited a seasonal fluctuation in employment, of over 120 percent in 1981, from a base of 7,860 to 17,435, in contrast to that of 1978 which fluctuated 59 percent, as shown in Figures B-8 and B-9. Seasonal employment is tied to the importance of natural resources to the New Brunswick economy.

A. KEY INDUSTRIES

Forestry

Forestry is the largest industry in New Brunswick. Productive forests cover 85 percent of the Province's land area, more than any other Canadian Province. 48 percent of the New Brunswick forest product industry is publicly owned and 52 percent is privately owned. In 1980, the gross value of production of the forestry industry was approximately $1 billion, or 9.4 percent of the Province's GDP. Forestry products accounted for over 50 percent of the Province's exports (and accounts for more than 40 percent of manufacturing output). Primary forestry activities employ 3 percent of the labor force; forestry activity is found in all counties.

Harvest levels increased 25 percent from 1970 to 1980. These increases in output did not spur significant increases in employment. Most of the increase in harvest was accounted for by increasing productivity.

New Brunswick's silviculture program is aimed at developing the Province's forestry resources to meet the needs of industry. Planning for the maintenance of the forests as a sustainable resource has to take place within the constraints of the 30 to 40 years required between planting and harvesting new forest resources. Without the silviculture program there would be severe deficits in softwood production, which accounts for over 80 percent of the demand from industry. There continues to be pressure on wood resources. This has led to the depletion of larger sized quality sawlogs and veneer logs of both soft and hardwood varieties.

Major forestry firms are J.D. Irving Ltd., Lock-Wood Ltd., New Brunswick International Paper, MacMillan Rothesay Ltd., Fraser Inc., and Boise Cascade.

Agriculture

In 1980 there were 3,700 farms in New Brunswick covering a total 763,000 acres. The agricultural industry ranks third among the primary industries in its contribution to the real Gross Domestic Product of the Province, estimated to be $34 million. Agriculture represents more than 2 percent of the labor force of New Brunswick. Activities related to agriculture, mainly processing of agricultural produce and transportation, contributed an additional 18,000 jobs. Fifty-seven percent of the agricultural sector's employment is concentrated in Kings, Carleton, York and Victoria Counties.

The gradual consolidation of farm land and an increase in the number of commercial firms has resulted in larger, more efficient and specialized farming operations.

Major firms in this industrial sector are Atlantic Sugar Ltd., G.E. Barbour Company, Ltd., McCain Food Ltd., Baxter Dairies, Ganong Bros. Ltd., and Hub Meat Packers. The major products are potatoes, dairy products, cattle and calves, which together accounted for $126.3M worth of production, 59 percent of the industrial total, in 1980.

Mining

The mining industry accounted for 3,000 jobs in 1984, roughly 3 percent of New Brunswick's G.D.P., and 9.3 percent of its exports. The industry is concentrated in Gloucester and Northumberland Counties. With the commencement of potash mining near Sussex in recent years, Kings County has assumed more importance as a mining area.

Mineral deposits in New Brunswick include metals such as zinc, lead, silver, copper, molybdenum and antimony and non-metallics such as peat moss, potash, and coal, and structural materials such as gravel, cement and stone.

Priorities in the mining industry are 1) the expansion and diversification of the resource base, 2) the acceleration of development of lower quality deposits and 3) improved recovery of existing resources. Examples of specific developments are a zinc smelter at Belledune, the tungsten and molybdenum deposit at Mt. Pleasant, and potash deposits in Sussex County.

Fisheries

The fisheries industry is the fourth ranked primary industry in the Province. 5,200 are employed in the primary fishery sectors, and 10,000 employed in the secondary (handling and processing) sector. The landings are processed at 130 plants and estimated value of shipments was $223 million in 1982. The market value of exports in the same years was $201M. Over the last twenty years, productivity in the primary sector has increased while employment has decreased. In the processing and handling sector, employment increased by 66 percent over the same period.

The three major fishing areas are the Gulf of St. Lawrence, the Northumberland Strait, and the Bay of Fundy. The major groundfish stock include cod, herring, redfish, hake, pollack and flatfish. The stocks of these fish have not recovered as forecast following the establishment of Canada's 200 mile Exclusive Economic Zone. Variety and value of production has been enhanced by diversification of operations and the development of new fisheries which include snowcrab, shrimp, gulf herring, scallop and eel.

Exports of fishery products increased 246 percent in the 1970's. The industry is still exposed to wide fluctuations in their marketing due to instability of supply and demand and variability of product quality.

Major firms are Connors Bros, Ltd., Gully Fish and Food Products Co. Ltd., National Sea Products, L'Association Cooperative des Pecheurs de L'Ile Ltee, and the United Marine Fisheries Corp.

Manufacturing

There were 1,356 manufacturing firms in New Brunswick in 1984. 90 percent of these were New Brunswick owned. Employment, as stated earlier in this Appendix, is subject to sharp seasonal fluctuations. In 1983, it was estimated to range from 26,000 to a peak of 49,000. Value of shipments in 1982 was $3.3 billion. Manufacturing firms accounted for 15 percent of the Province's real domestic product in 1984.

Manufacturing is spread over all regions of New Brunswick. Although all major manufacturing sectors are represented in New Brunswick, the Province has been dominated by the processing of locally available primary resources, notably from the fishing, forestry, agricultural and mining industries. A priority for manufacturing development in the 1970's was to diversify the economic base. Some diversification took place, although the same industries still dominate.

Since New Brunswick has a population which is restrictively small and geographically dispersed, another priority was to foster export based industries in order to promote economic growth. Manufacturing continues to be the sector sought to provide job opportunities for the expanding labor force. The primary industries have increased output over the last decade. This has been due to gains in productivity and has had little effect on total number employed. These trends will continue, and the importance of manufacturing in the New Brunswick economy will increase.

B. STRENGTHS AND WEAKNESSES

The profile of New Brunswick economy can be summarized by outlining the key strengths and weaknesses of Province as they related to future economic development:

Strengths

- Extensive natural resource base;
- Good port facilities;
- Stable labor force with relatively low wage rates;
- Large New Brunswick-based companies which are a source of ideas, leadership, and international market experience; and
- Low cost of living and high quality of life.

Weaknesses

- Small internal market limiting economies of scale;
- Narrow industrial base;
- Prevailing regulatory and bureaucratic environment;
- Insufficient business expertise in both the private and public sectors;
- Immature entrepreneurial culture and high degree of risk aversion;
- Limited interaction and coordination between universities, research institutions, government and industry;
- High energy costs compared to areas with which New Brunswick competes; and
- High transportation costs and limited air access.

TABLE B-1

1981 EMPLOYMENT BY INDUSTRY BY COUNTY

Industries	Albert	Carleton	Charlotte	Gloucester	Kent	Kings	Madawaska	Northumberland
Agriculture	140	1,295	135	305	390	1,110	425	270
Forestry	130	575	260	1,005	340	410	845	1,715
Fishing and Trapping	5	15	740	995	480	30	0	385
Mines	0	40	75	2,155	20	200	0	695
Manufacturing	190	2,435	3,480	8,270	1,530	1,165	2,725	2,550
Construction	260	470	990	2,235	700	945	985	1,405
Transportation, Comm. & Other Utilities	310	920	940	1,300	410	675	875	805
Trade-Commerce	735	1,710	1,360	5,270	1,040	1,970	1,990	3,080
Finance, Insurance & Real Estate	120	245	220	845	190	335	425	435
Community, Business & personal	1,185	2,180	2,815	8,745	2,215	3,070	3,995	4,430
Public Admin. & Defense	380	540	760	1,895	470	440	820	2,600
Total All Industries	3,460	10,435	11,775	33,015	7,775	10,350	13,095	18,360

Industries	Queens	Restigouche	St. John	Sunbury	Victoria	Westmorland	York	New Brunswick	Canada
Agriculture	210	190	115	180	870	630	785	7,075	486,995
Forestry	380	800	365	185	590	320	1,570	9,765	102,960
Fishing & Trapping	25	85	65	15	10	295	40	3,405	37,790
Mines	315	50	100	15	5	75	135	3,875	216,445
Manufacturing	690	3,300	8,710	430	1,665	7,915	3,380	48,730	2,279,360
Construction	220	1,115	4,550	240	460	3,545	2,385	21,210	767,105
Transportation, Comm. & Other Utilities	475	1,235	7,205	255	650	8,200	2,825	27,430	960,770
Trade-Commerce	455	2,390	9,580	545	1,290	11,310	6,530	49,580	2,004,135
Finance, Insurance & Real Estate	60	345	2,925	125	170	2,780	1,410	10,680	636,070
Community, Business & personal	1,035	5,135	14,750	1,260	2,095	16,180	12,205	81,595	3,477,245
Public Admin. & Defense	2,085	780	3,255	3,330	375	4,810	5,955	28,685	908,155
Total All Industries	5,960	15,435	51,610	6,575	8,175	56,055	37,215	292,025	11,877,035

Source: Statistics Canada

TABLE B-2

PRIMARY AND MANUFACTURING EMPLOYMENT IN NEW BRUNSWICK -- 1981

(HIGHLIGHTING AGRICULTURE, FORESTRY, FISHING SECTORS WITH THEIR RESPECTIVE PROCESSING INDUSTRIES)

	Agriculture and Agricultural Manufacturing[1]			Forestry and Forest Products[2]			Fishing and Fishing Products[3]			Mining and Mining Products[4]			Other Manufacturing				
	Total	Percent Of Province	Percent Of County's Manufacturing & Primary Employment	Total	Percent Of Province	Percent Of County's Manufacturing & Primary Employment	Total	Percent Of Province	Percent Of County's Manufacturing & Primary Employment	Total	Percent Of Province	Percent Of County's Manufacturing & Primary Employment	Total	Percent Of Province	Percent Of County	Primary and Manufacturing County Total	Percent Of Total Employment
Albert	146	1.1	31.1	205	0.9	43.9	5	0.1	1.1	0	0.0	0.0	112	0.5	23.9	468	13.5%
Carleton	2278	16.4	51.9	1023	4.8	23.3	26	0.3	0.6	40	0.7	0.9	1023	4.5	23.3	4390	42.1%
Charlotte	455	3.3	9.7	766	3.6	16.3	2497	27.2	52.9	338	6.0	7.2	657	2.9	13.9	4713	40.0%
Gloucester	1016	7.4	7.9	1797	8.3	14.6	3304	36.1	25.7	2743	49.0	21.3	3989	17.5	31.1	12849	38.9%
Kent	756	5.5	27.3	630	2.9	22.7	984	10.7	35.5	31	0.6	1.1	370	1.6	13.4	2771	35.6%
Kings	1597	11.6	54.5	640	3.0	21.9	43	0.5	1.5	202	3.6	6.9	446	2.0	15.2	2928	28.3%
Madawaska	477	4.9	16.7	2215	10.3	54.7	0	0.0	0.0	0	0.0	0.0	1158	5.1	28.6	4050	30.9%
Northumberland	356	2.6	6.3	3239	15.0	57.4	508	5.5	9.0	1280	22.8	22.7	261	1.1	4.6	5644	30.7%
Queens	214	1.6	13.1	734	3.4	45.0	25	0.3	0.2	315	5.6	19.3	343	1.5	21.0	1631	27.4%
Restigouche	215	1.6	4.8	3057	14.2	67.9	96	1.0	2.1	50	0.9	1.1	1081	4.7	24.0	4499	49.1%
St. John	963	7.0	10.1	1894	8.8	19.8	544	5.9	5.7	114	2.0	1.2	6055	26.5	63.3	9570	18.5%
Sunbury	196	1.4	23.4	219	1.0	26.2	16	0.2	1.9	15	0.3	1.8	390	1.7	46.7	836	12.7%
Victoria	1655	12.0	52.6	1027	4.8	32.5	19	0.2	0.6	5	0.1	0.1	447	2.0	14.2	3153	38.6%
Westmoreland	2252	16.4	24.0	1228	5.7	13.1	1055	11.5	11.3	111	2.0	1.2	4729	20.8	50.4	9375	16.7%
York	991	7.2	16.6	2847	13.3	47.6	51	0.6	0.9	360	6.4	6.0	1724	7.6	28.9	5973	16.0%
		100.0			100.0			100.0			100.0			100.0			
Provincial Total for Industry Sector:	13767	(18.9%)		21521	(29.5%)		9173	(12.6%)		5604	(7.7%)		22785	(31.3%)		72850	

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[1] Primary agricultural sector and a proportion of food processing sector proportional to the numbers employed in agriculture versus fisheries in that country.

[2] Forestry sector and wood industries and furniture and fixtures and paper and allied.

[3] Fisheries sector and a proportion of food processing proportional to the numbers employed in fisheries versus agriculture in that country.

[4] Mining sector and primary metals.

TABLE B-3

1981 LOCATION COEFFICIENTS

Industries	Albert	Carleton	Charlotte	Gloucester	Kent	Kings	Madawaska	Northumberland
Agriculture	1.67	5.12	0.47	0.38	2.07	4.43	1.34	0.61
Forestry	1.12	1.65	0.66	0.91	1.31	1.18	1.93	2.79
Fishing & Trapping	0.12	0.12	5.39	2.58	5.29	0.25	0.00	1.80
Mines	0.00	0.29	0.48	4.92	0.19	1.46	0.00	2.85
Manufacturing	0.33	1.40	1.77	1.50	1.18	0.67	1.25	0.83
Construction	1.03	0.62	1.16	0.93	1.24	1.26	1.04	1.05
Transportation, Comm. & Other Utilities	0.95	0.94	0.85	0.42	0.56	0.69	0.71	0.47
Trade-Commerce	1.25	0.97	0.68	0.94	0.79	1.12	0.90	0.99
Finance, Insurance & Real Estate	0.95	0.64	0.51	0.70	0.67	0.89	0.89	0.65
Community, Business & personal	1.23	0.75	0.86	0.95	1.02	1.06	1.09	0.86
Public Admin. & Defense	1.12	0.53	0.66	0.58	0.62	0.43	0.64	1.44
Total All Industries	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Industries	Queens	Restigouche	St. John	Sunbury	Victoria	Westmorland	York
Agriculture	1.45	0.51	0.09	1.13	4.39	0.46	0.87
Forestry	1.91	1.55	0.21	0.84	2.16	0.17	1.26
Fishing & Trapping	0.36	0.47	0.11	0.20	0.10	0.45	0.09
Mines	3.98	0.24	0.15	0.17	0.05	0.10	0.27
Manufacturing	0.69	1.28	1.01	0.39	1.22	0.85	0.54
Construction	0.51	0.99	1.21	0.50	0.77	0.87	0.88
Transportation, Comm. & Other Utilities	0.85	0.85	1.49	0.41	0.85	1.56	0.81
Trade-Commerce	0.45	0.91	1.09	0.49	0.93	1.19	1.03
Finance, Insurance & Real Estate	0.28	0.61	1.55	0.52	0.57	1.36	1.04
Community, Business & personal	0.62	1.19	1.02	0.69	0.92	1.03	1.17
Public Admin. & Defense	3.56	0.51	0.64	5.16	0.47	0.87	1.63
Total All Industries	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Source: Arthur D. Little, Inc. estimates

TABLE B-4

PERCENT OF SMALL AND LARGE COMPANIES WITHIN MANUFACTURING SECTOR, 1981

Industry	Total Employees	Small Companies Less than 25 Employees	Percent of Industry	Medium Companies	Percent of Industry	Large Companies More than 200 Employees	Percent of Industry	Code
Food and Beverage	12647	1212	9.58	4288	33.91	7147	56.51	FB
Tobacco	123	49	39.84	74	60.16	0	0.00	TB
Rubber and Plastic	200	109	54.50	91	45.50	0	0.00	RP
Leather*	178	15	8.43	163	91.57	0	0.00	LE
Textile	329	72	21.88	257	78.12	0	0.00	TE
Clothing	469	7	1.49	227	48.40	235	50.11	CL
Wood	5475	1412	25.79	2838	51.84	1225	22.37	WO
Furniture and Fixtures	806	184	22.83	422	52.36	200	24.81	FF
Paper and Allied	5739	45	0.78	611	10.65	5083	88.57	PA
Printing	1201	471	39.22	530	44.13	200	16.65	PR
Primary Metal	1724	34	1.97	29	1.68	1661	96.35	PM
Metal Fab	2952	668	22.63	1877	63.58	407	13.79	MF
Machinery	968	137	14.15	831	85.85	0	0.00	MA
Transportation	2380	213	8.95	392	16.47	1775	74.58	TR
Electrical Products	713	80	11.22	333	46.70	300	42.08	EP
Non Met Minerals	1884	465	24.68	1189	63.11	230	12.21	NM
Petroleum and Coal	1459	136	9.32	533	36.53	790	54.15	P&C
Chemicals	494	197	39.88	297	60.12	0	0.00	CH
Miscellaneous	846	360	42.55	102	12.06	384	45.39	MS
Total	40873	5866	14.35	15371	37.61	19636	48.04	TO

* Textiles only

Sources: Department of Commerce and Arthur D. Little, Inc. estimates.

TABLE B-5

COMPARISON OF NEW BRUNSWICK MANUFACTURING
1978-1984

Manufacturing[1]		New Brunswick				Growth Rates			
		1978	1980	1982	1984	1978-1980	1980-1982	1982-1984	1978-1984
Food and Beverage	Firms	223	239	265	292				
	Employees	12914	13499	12613	14615	2.24%	-3.34%	7.64%	2.08%
Tobacco Products	Firms	6	6	6	6				
	Employees	97	130	104	95	15.77%	-10.56%	-4.42%	-0.35%
Rubber & Plastics	Firms	15	17	16	24				
	Employees	172	258	218	309	22.47%	-8.08%	19.06%	10.26%
Leather	Firms	7	8	8	9				
	Employees	183	177	182	211	-1.65%	1.40%	7.67%	2.40%
Textiles	Firms	22	22	20*	26				
	Employees	426	654	349	315	23.90%	-26.95%	-5.00%	-4.91%
Clothing	Firms	7	9	10	18				
	Employees	598	610	571	799	1.00%	-3.25%	18.29%	4.95%
Wood	Firms	228	252	241	264				
	Employees	5057	6254	6165	4646	11.21%	-0.71%	-13.19%	-1.40%
Furniture & Fixtures	Firms	7	9	10	18				
	Employees	815	743	589	565	-4.52%	-10.96%	-2.06%	-5.92%
Paper & Allied	Firms	21	20	23	26				
	Employees	5314	5586	5596	5346	2.53%	0.09%	-2.26%	0.10%

---

[1] Employees totals are average of maximum and minimum numbers of employees.

TABLE B-5 (Continued)

Manufacturing		New Brunswick				Growth Rates			
		1978	1980	1982	1984	1978-1980	1980-1982	1982-1984	1978-1984
Printing, Pub & Allied	Firms	69	77	74	74				
	Employees	1203	1405	1259	1395	8.07%	-5.34%	5.26%	2.50%
Primary Metals	Firms	3	6	8	7				
	Employees	557	843	1263	883	23.02%	22.40%	-16.39%	7.98%
Metal Fabricating	Firms	136	148	156	166				
	Employees	2366	3493	2359	2159	21.50%	-17.82%	-4.33%	-1.51%
Machinery	Firms	25	31	37	50				
	Employees	506	779	825	645	24.08%	2.91%	-11.58%	4.13%
Transportation Eqpt	Firms	32	52	50	52				
	Employees	2190	2295	2060	1436	2.37%	-5.26%	-16.51%	-6.79%
Electrical Products	Firms	15	13	18	19				
	Employees	842	499	454	479	-23.02%	-4.62%	2.72%	-8.97%
Non-Metallic Minerals	Firms	100	104	102	109				
	Employees	2069	2149	1721	1581	1.91%	-10.51%	-4.15%	-4.38%
Petroleum & Coal	Firms	21	22	23	21				
	Employees	1091	1475	1197	1038	16.27%	-9.92%	-6.88%	0.83%
Chemical & Chem Products	Firms	28	37	38	35				
	Employees	405	1074	515	478	62.85%	-30.75%	-3.66%	2.80%
Miscellaneous	Firms	77	80	83	89				
	Employees	814	928	830	795	6.77%	-5.43%	-2.13%	-0.39%
Total Manufacturing	Firms	1097	1207	1246	1356				
	Employees	37617	42845	37241	37790	6.72%	-6.77%	0.73%	0.08%

*Textile only

Sources: Department of Commerce and Arthur D. Little, Inc. estimates.

TABLE B-6

SEASONAL FLUCTUATIONS WITHIN MANUFACTURING SECTOR

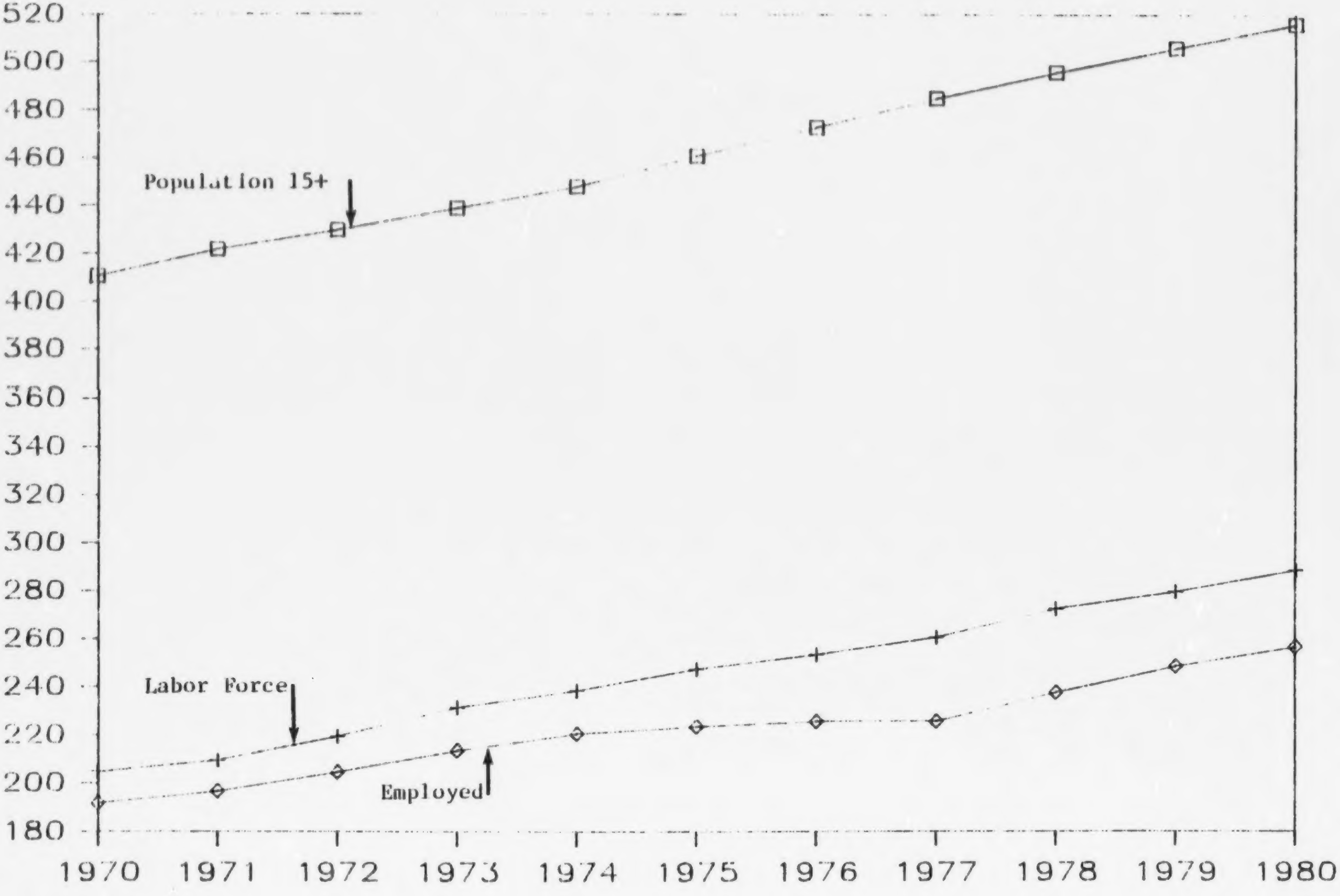
	1978		1981		
Industry	Number of Base Employees	Seasonal Fluctuation	Number of Base Employees	Seasonal Fluctuation	Code
Food and Beverage	9978	58.84	7860	121.82	FB
Tobacco	75	58.67	77	118.18	TB
Rubber and Plastics	148	32.43	172	31.98	RP
Leather *	176	7.39	175	2.86	LE
Textiles	401	12.72	285	30.53	TE
Clothing	581	5.85	420	23.33	CL
Wood	4664	16.85	4702	32.90	WO
Furniture	789	6.46	735	19.32	FF
Paper & Allied	5129	7.21	5575	5.88	PA
Printing	1162	7.06	1143	10.15	PR
Primary Metal	550	2.55	1676	5.73	PM
Metal Fab	2126	22.58	2339	52.42	MF
Machinery	476	12.39	783	47.25	MA
Transportation Equipment	2147	3.85	2020	35.59	TR
Electric Products	833	2.16	612	33.01	EP
Non Metallic Minerals	1632	54.11	1244	102.81	NMP
Petroleum and Coal	1030	11.75	1225	38.20	PC
Chemicals	360	25.00	388	29.76	CH
Miscellaneous	757	15.06	736	29.76	MS
Total of Base Employees	33014	27.88	32435	52.03	TO

Sources: Department of Commerce and Arthur D. Little, Inc. estimates.

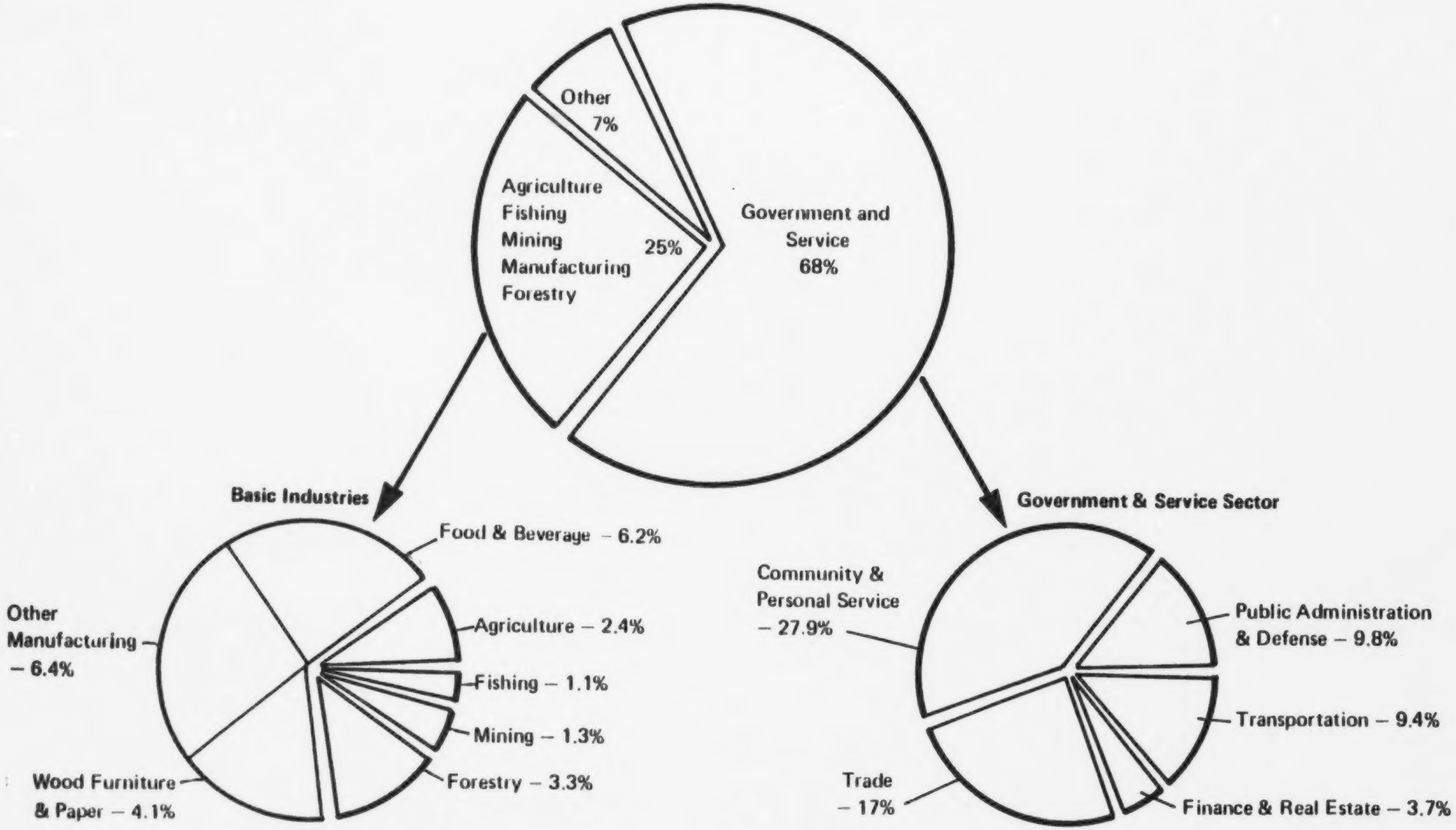
*Textiles only

FIGURE B-1

LABOR STATISTICS



Source: Statistics Canada

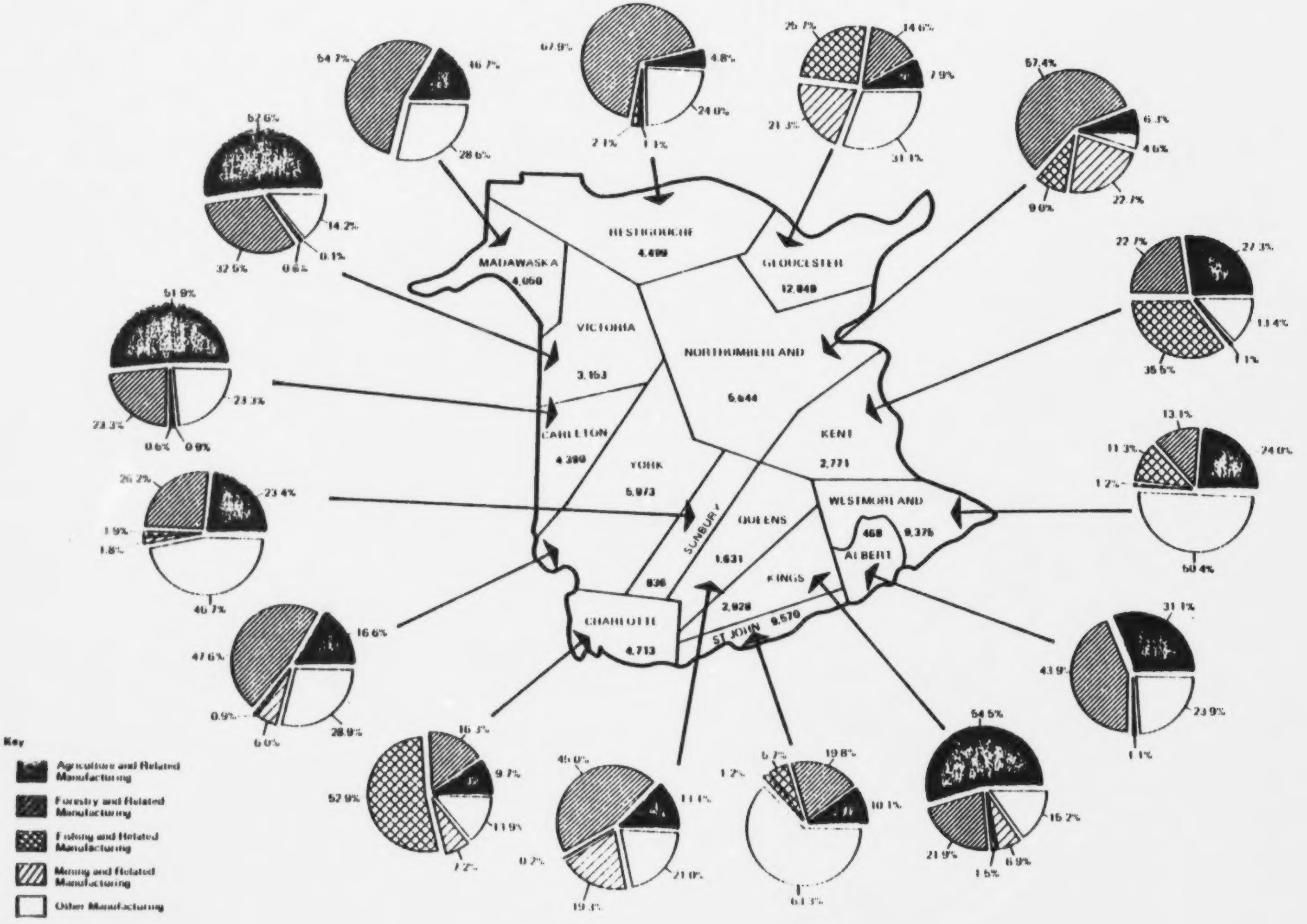


Sources: Statistics Canada.
Arthur D. Little, Inc., estimates.

FIGURE B-2 NEW BRUNSWICK EMPLOYMENT STRUCTURE, 1981

FIGURE B 3

AGRICULTURE, FORESTRY, FISHING, MINING AND RELATED MANUFACTURING AS PERCENTAGES OF TOTAL PRIMARY AND SECONDARY EMPLOYMENT IN NEW BRUNSWICK 1981


MADAWASKA
4,050
RESTIGOUCHE
4,499
GLOUCESTER
12,848
VICTORIA
3,163
NORTHUMBERLAND
5,644
CARLETON
4,390
YORK
5,973
KENT
2,771
WESTMORLAND
9,376
ALBERT
468
SUNBURY
836
QUEENS
1,631
KINGS
2,928
CHARLOTTE
4,713
ST JOHN
9,570
54.7%
16.7%
28.6%
67.9%
4.8%
24.0%
2.1%
1.1%
25.7%
14.6%
7.9%
21.3%
31.1%
57.4%
6.3%
4.6%
22.7%
9.0%
52.6%
14.2%
0.1%
0.6%
32.5%
22.7%
27.3%
13.4%
1.1%
35.5%
51.9%
23.3%
23.3%
0.6%
0.9%
13.1%
11.3%
24.0%
1.2%
60.4%
26.2%
23.4%
1.9%
1.8%
46.7%
31.1%
43.9%
23.9%
1.1%
47.6%
16.6%
0.9%
6.0%
28.9%
16.3%
9.7%
52.9%
11.9%
7.2%
45.0%
11.1%
0.2%
21.0%
19.3%
6.7%
19.8%
1.2%
10.1%
61.3%
54.5%
15.2%
21.9%
1.5%
6.9%
Key
Agriculture and Related Manufacturing
Forestry and Related Manufacturing
Fishing and Related Manufacturing
Mining and Related Manufacturing
Other Manufacturing

Numbers represent total primary and manufacturing employment per county

FIGURE B-4

PRIMARY AND MANUFACTURING EMPLOYMENT AS A PERCENTAGE OF TOTAL EMPLOYMENT, BY COUNTY 1981

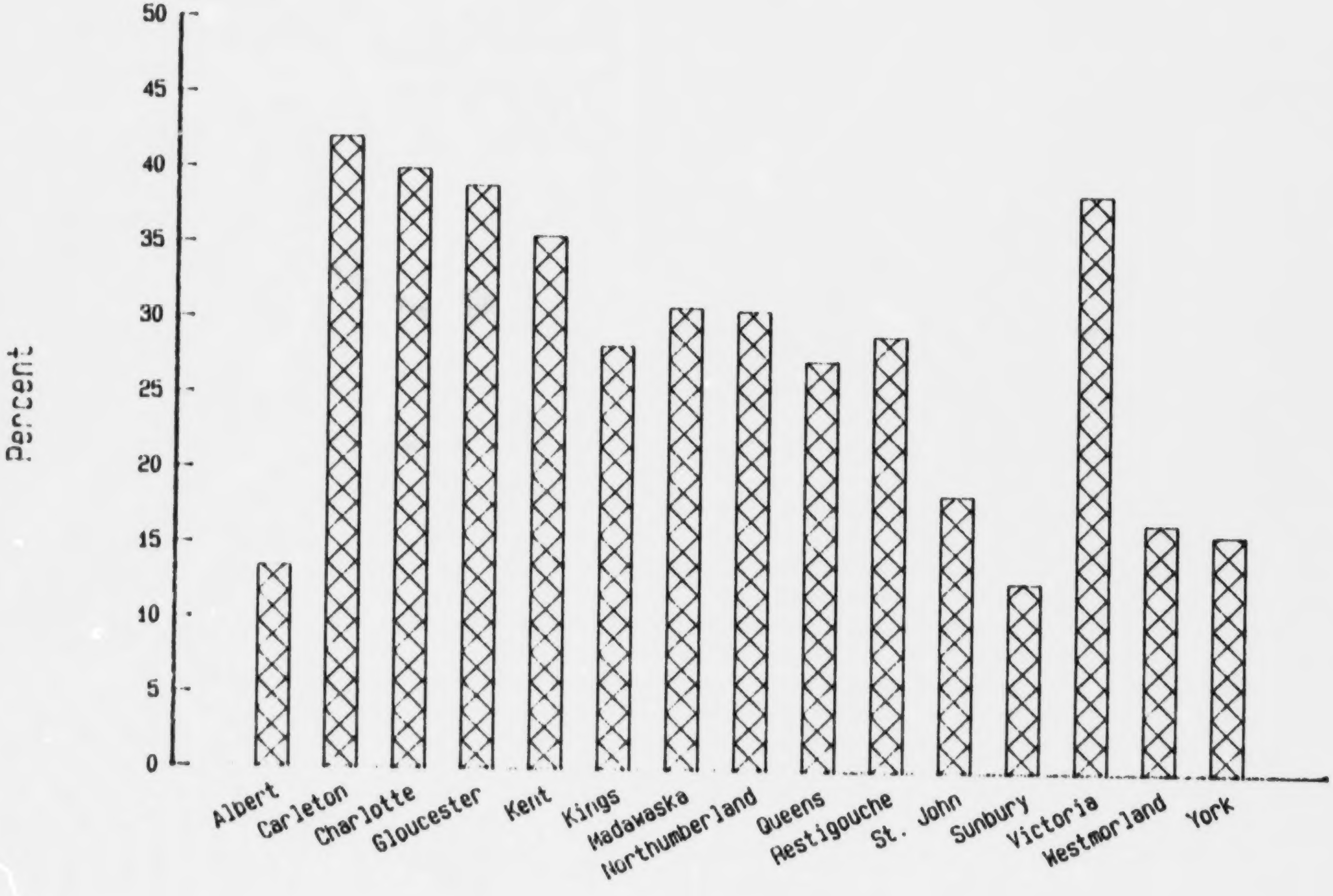
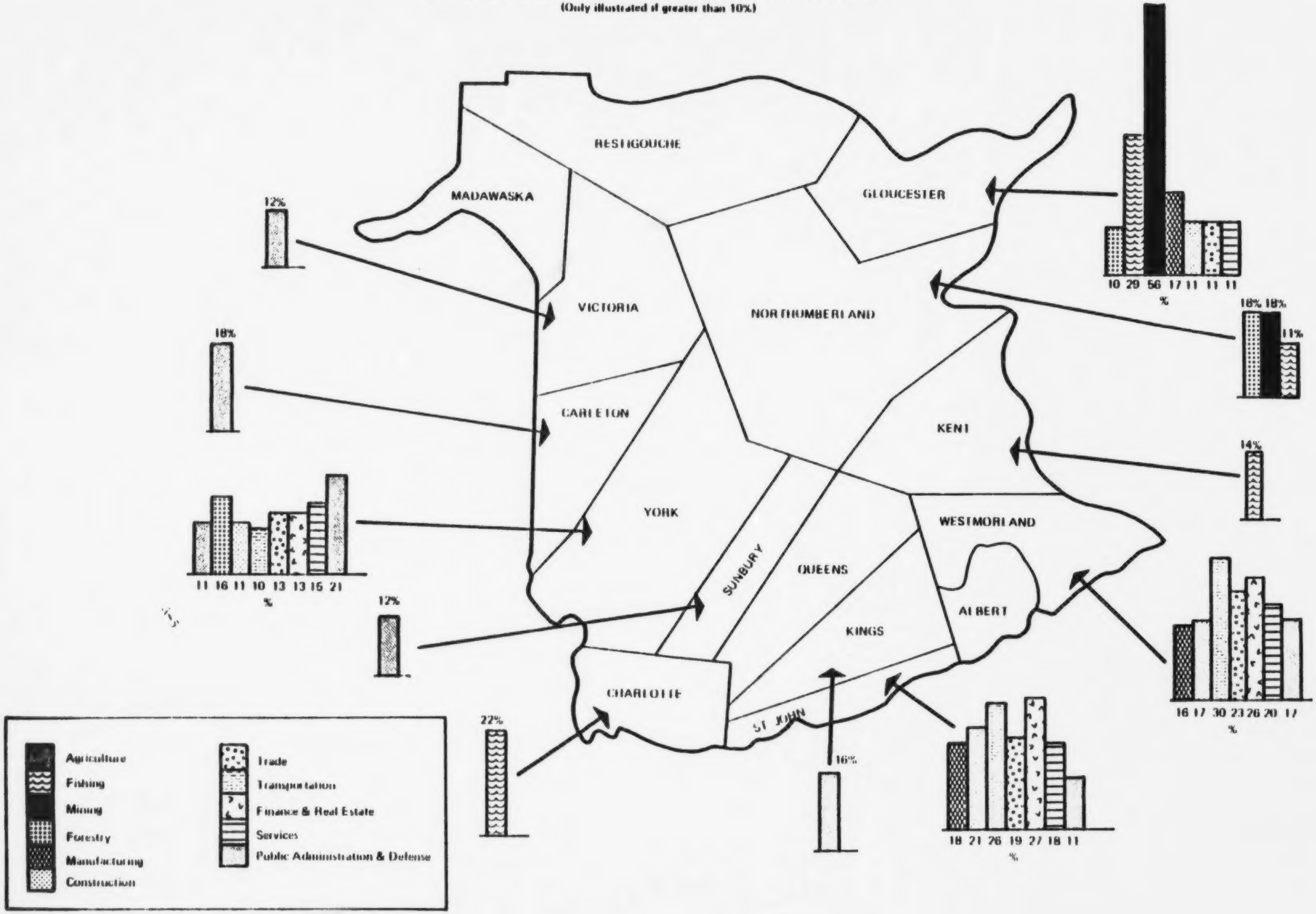


FIGURE B 5

PERCENTAGES OF NEW BRUNSWICK'S EMPLOYMENT, BY COUNTY, BY SECTOR
(Only illustrated if greater than 10%)


RESTIGOUCHE
MADAWASKA
GLOUCESTER
VICTORIA
NORTHUMBERLAND
CARLETON
KENT
YORK
WESTMORLAND
SUNBURY
QUEENS
ALBERT
KINGS
CHARLOTTE
ST JOHN
10 29 56 17 11 11 11
%
18% 18% 11%
14%
16 17 30 23 26 20 17
%
18 21 26 19 27 18 11
%
16%
22%
12%
11 16 11 10 13 13 15 21
%
18%
12%
Agriculture
Fishing
Mining
Forestry
Manufacturing
Construction
Trade
Transportation
Finance & Real Estate
Services
Public Administration & Defense

Sources: Statistics Canada and Arthur D. Little, Inc. estimates

FIGURE B 6

PERCENT OF EMPLOYEES IN MANUFACTURING BY COMPANY SIZE - 1981

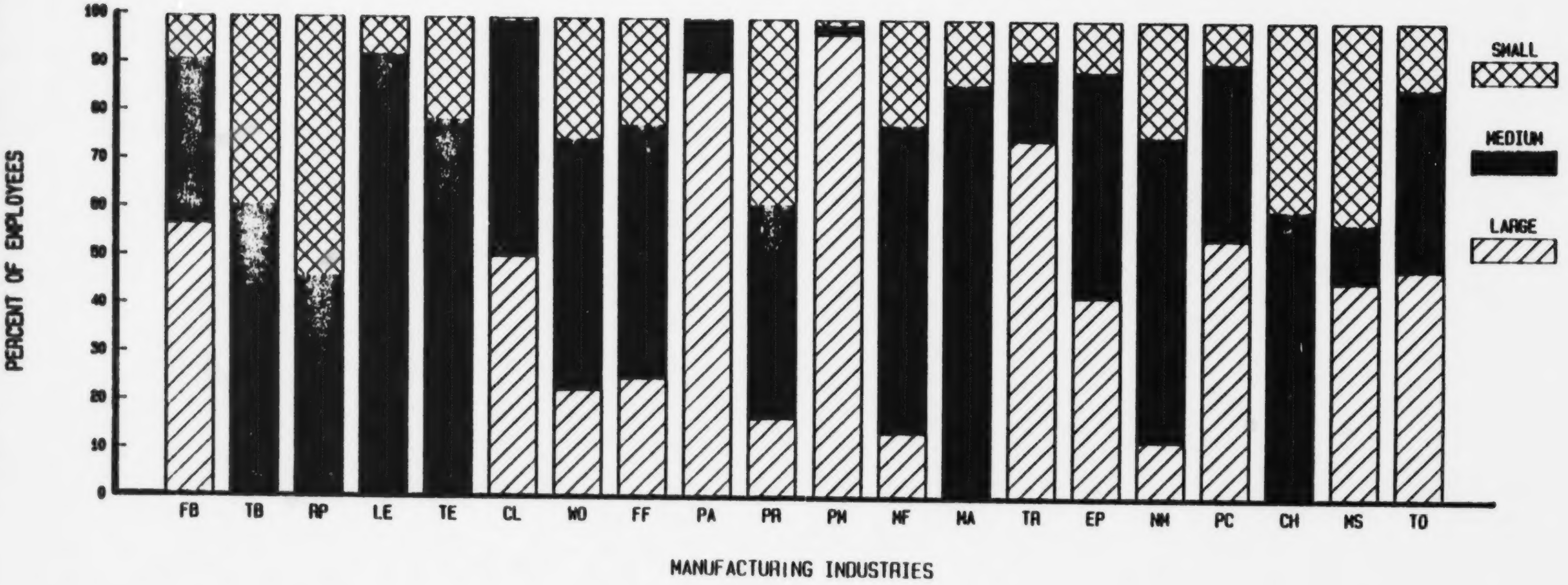
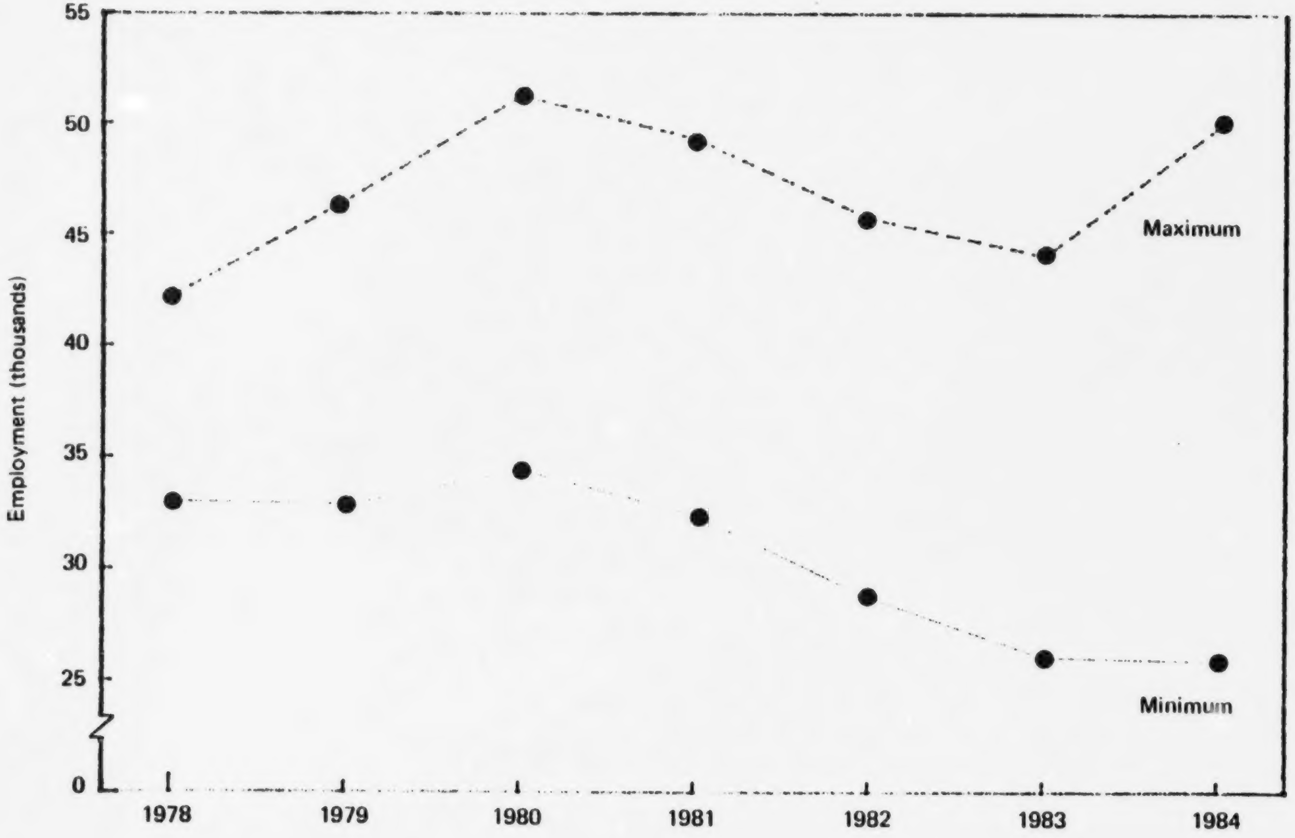


FIGURE B-7

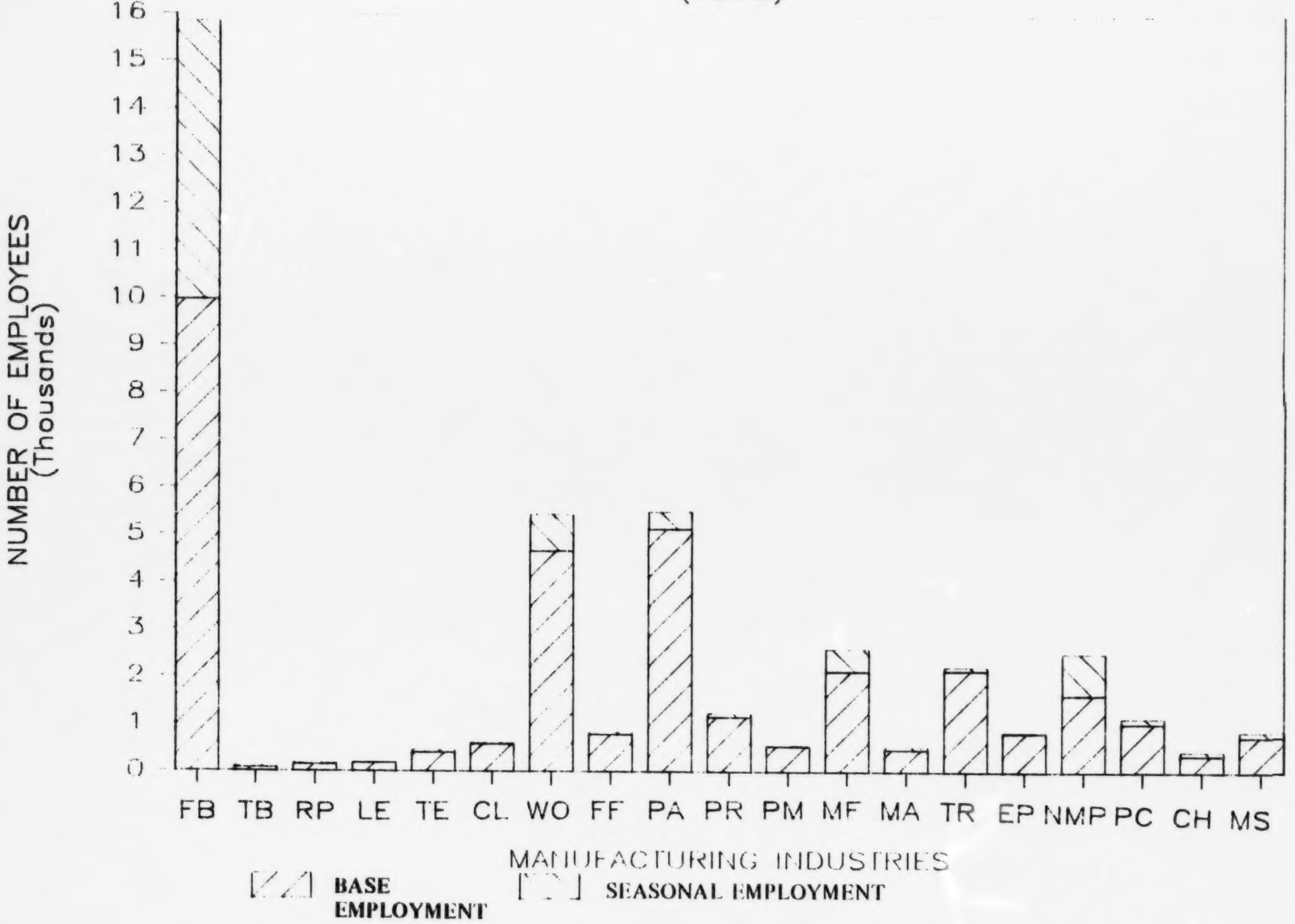
MINIMUM AND MAXIMUM MANUFACTURING EMPLOYMENT: 1978 TO 1984



Source: Department of Commerce and Development Statistics.

FIGURE B-8

SEASONAL EMPLOYMENT FLUCTUATIONS
(1978)

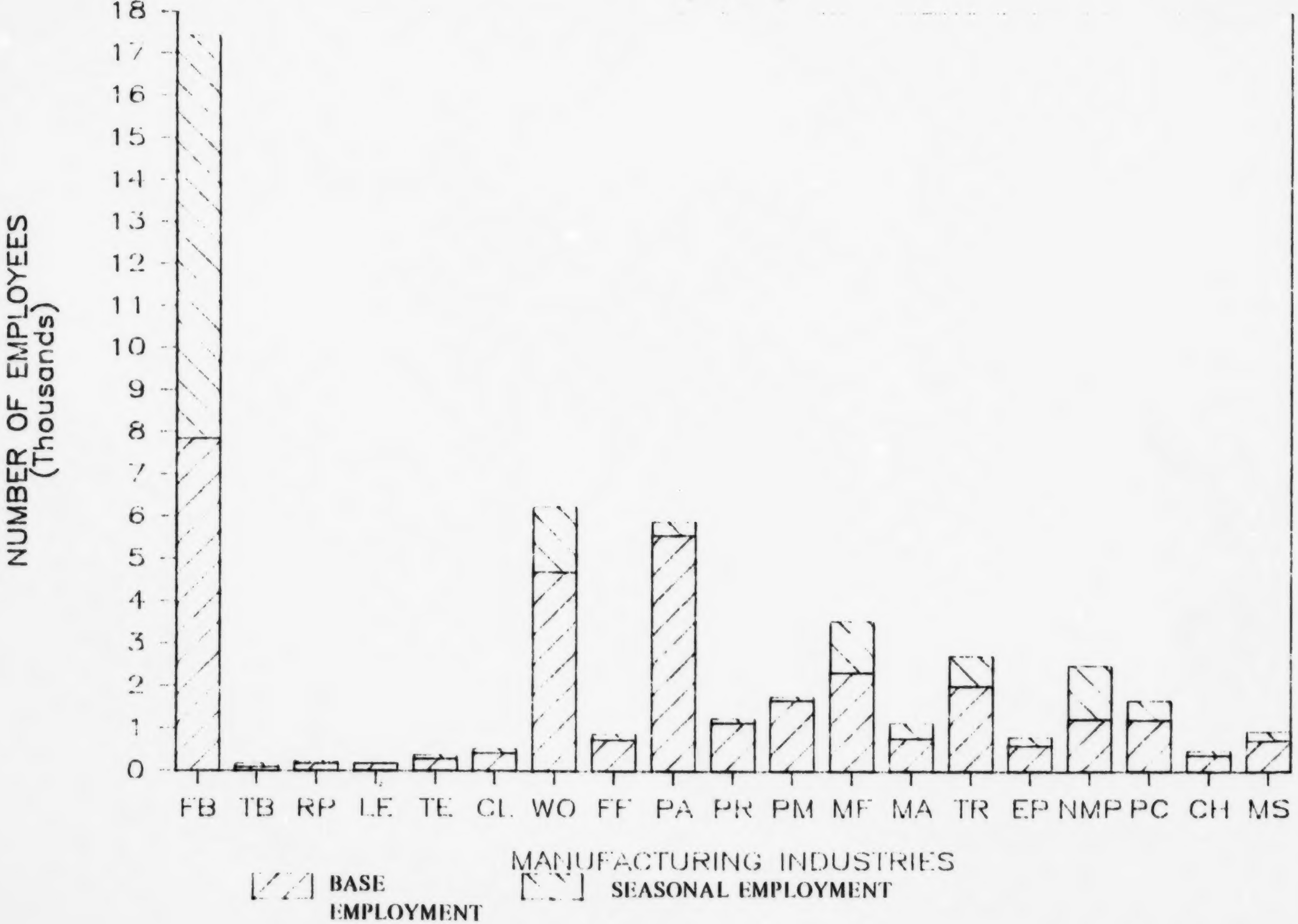


Sources: Statistics Canada
Arthur D. Little, Inc. estimates

FIGURE B-9

SEASONAL EMPLOYMENT FLUCTUATIONS

(1981)



Sources: Statistics Canada
Arthur D. Little, Inc. estimates

APPENDIX C

SCIENCE AND TECHNOLOGY CONTEXT

APPENDIX C

SCIENCE AND TECHNOLOGY CONTEXT

The principle New Brunswick Science and Technology capabilities that are summarized in this appendix are:

1. Research and Productivity Council (RPC)
2. Manufacturing Technology Centre (MTC)
3. Centre for Application of Development of Microelectronics Inc. (CADMI)
4. University of New Brunswick (UNB)
5. Universite de Moncton (U de M)
6. Department of Fisheries and Oceans Laboratory of St. Andrews (DFO)
7. Huntsman Marine Laboratory (HML)
8. Atlantic Salmon Research Institute (ASRC)
9. Centre pour Recherche et Developpement de la Tourbe (The Peat Institute)

Following these profiles is a summary of New Brunswick Government activities in Science and Technology based on the 1984 survey sponsored by the Department of Commerce and Development.

Research and Productivity Council

RPC was founded by an Act of New Brunswick Legislature that came into law on April 13, 1962.

1. OBJECTIVE:

To promote, stimulate and expedite continuing improvement in productive efficiency and expansion in the various sectors of the New Brunswick economy.

a) Research and studies particularly in

- conservation, development of natural resources
- processing of by-products of primary industries
- improvement and development of industrial materials

b) Cooperate with the National Research Council to foster and promote: development of improved production and distribution; improved management techniques; good human relations, life of training and retraining in all areas of industry; extension of industrial research programs in plants and in industry to achieve greater productivity.

c) Cooperate and act in conjunction with other organizations and agencies, public and private in the implementation of programs.

2. SIZE:

a) Staff: from original small staff of approximately four, there are now 119 employees (1983: latest figure)

b) Budget ($ and sources)

1983

Provincial government	$ 300,000 (grant)*
Provincial government	$ 918,000 (Contracts)
Federal government	$1,502,000
Industry	$1,884,000
Other Canadian Sources	$ 581,000
Foreign sources	$ 622,000
	$5,870,000

*This figure has been increased to $600,000.

3. AREA OF EXPERTISE:

- Process Chemistry: physical, inorganic, analytic and organic chemistry

- Process Engineering: Reactor design, flowsheet design, materials evaluation
- Extractive Metallurgy: hydro-and pyrometallurgy
- Process Control and Evaluation
- Technico-economic feasibility studies
- Pyrolysis, roasting and combustion
- Gaseous, liquids and solids analysis
- Hazardous waste disposal
- Energy balances

4. SPECIFIC PROGRAMS:

The percentage of expenditure on types of program is:

Test and Analysis	34%	
Engineering and Science	22%	
Engineering Development	14%	
Technico-economic studies	1%	
Product engineering	15%	
Technical information	10%	
Industrial innovation	4%	(1983 figures)
	100%	

Examples of specific programs are:

- technical support for nuclear power generation. (RPC has had a 10 year involvement with N.B. Power Corp.)
- prototype development of peat production material
- pest control for forestry and agriculture
- technical planning in coal mining industry
- improvement of shellfish growth in aquaculture
- provision of information on hazardous chemicals in industrial working environment
- CAD/CAM computer aided design/computer aided manufacturing services
- sulfation roast leach process (SRLP) to improve efficiency in mineral extraction

5. CLIENTELE:

The clientele can be divided into two groups:

a) Fully funded research and development work for those companies that can afford the services.

b) Provision of problem solving and technical information at minimal or zero cost to small sized firms. The IRAP grant supports 4 to 5 employees for this purpose and the RPC itself provides a further 4.

The clientele is mainly drawn from New Brunswick, with industrial contracts providing an increasing proportion of the income. Utilities companies, particularly the New Brunswick power corporation, are important clients.

A certain number of foreign clients have used RPC services, particularly Wolsung Nuclear Plant in Korea. Others over the last four years have been Jamaica, Sri Lanka (fishing study) Indonesia (metallurgical study), Guyana (fishing study), Barbados (fishing study) and an SRLP study for Anaconda Inc. of Tuscon, Arizona.

6. NETWORK:

RPC has close contact with Federal and Provincial government departments e.g. IRAP/TIS contract, Federal laboratories in New Brunswick such as the Federal Forest Laboratory of Agriculture Canada at Fredericton, the Canadian Forestry Service, and the Regional Laboratory of the Department of Fisheries and Oceans at St. Andrews.

Contact and exchange of information with the New Brunswick Universities has typically been poor with only several exceptions (e.g. the spruce budworm project, CAD/CAM, nuclear engineering..)

RPC is involved in the MTC (Manufacturing Technology Center) which groups the universities of New Brunswick and Moncton, the community colleges of Bathurst, St. John and Moncton and the RPC in a project to aid the transfer of CAD/CAM and related technologies and skills into New Brunswick Industry.

The Manufacturing Technology Centre (MTC)

MTC was originally proposed in 1981 and set up by the Department of Commerce and Development of New Brunswick in January 1983.

1. OBJECTIVES:

a) to speed the introduction of CAD/CAM (Computer Aided Design and Computer Aided Manufacturing) into private industries;

b) to assist in the transfer of technology;

c) to do research work;

d) to provide critical skill training;

e) to build upon existing strengths; and

f) to provide assistance in both official languages.

2. SIZE:

Budget ($ and source): To date has been $1,099,005 made up of $236K contracts (ranging from hundred+ of $ to $35,000) and $862,042 of grants and contributions (including a $773,842 original equipment grant).

3. AREAS OF EXPERTISE:

As outlined in "objectives". Peter Lewell stated that MTC is the most effective approach to university/industry interface yet tried.

4. SPECIFIC PROGRAMS:

Examples:	Development of Camapt system:	$35,000
	Post Processor for Okuma:	$ 6,000
	Basic Unigraphics (Agric Canada):	$ 1,500
	Plotting Package (Agric Canada):	$ 2,500
	Unigraphics training (NRC):	$ 1,500

5. CLIENTELE:

The clientele has encompassed:

- Federal government agencies: e.g., NRC, Agriculture Canada
- Provincial government agencies: e.g., RPC
- Private Industry

6. NETWORK:

There are six facilities located around the province. They are all coordinated by an advisory board that includes representatives of industry, universities, RPC, community colleges and Dept. of Commerce and Development.

The six sited are: University of New Brunswick, University de Moncton, RPC, and the Community Colleges at Moncton, Bathurst and St. John. All are connected by a VAX computer located at U.N.B.

Centre for Applications and Development of Microelectronics Incorporated (CADMI)

1. OBJECTIVES:

CADMI is a microelectronics centre operated jointly by the University of New Brunswick and Universite' de Moncton. Its mandate from the Federal Department of Industry, Trade and Commerce (now DRIE) is to help industry develop potential applications for computerization, automation and other forms of microcircuitry.

2. SIZE:

Budget ($ and source): CADMI receives $200,000 per year for five years of operation from the Federal Government, on the basis that the Centre will be self sufficient by that time.

3. AREAS OF EXPERTISE:

Feasibility studies in incorporation of microelectronics in products or in operations, implementing the recommendations of such a study on the shop floor and custom microcircuitry design. CADMI can assist industry in every phase:

- Drawing up proposals; and
- Carrying through the projects, including staff training.

4. SPECIFIC PROGRAMS:

a) Computerized tallying for lumber and manufactured projects.

b) Automated energy monitoring and control.

c) Rock stress sensing in mines.

d) Reserve and cash flows modelling.

No more specific details of particular companies or value of contracts were available.

5. CLIENTELE:

Priority is given to indigeneous, resource based and small to mid-sized industries. Projects in fisheries, forestry, mining and petroleum industry have been emphasized.

6. NETWORK:

CADMI mainly sources the technical expertise from the science and engineering faculties of the two universities at which it is based, i.e., University of New Brunswick and Universite de Moncton, although experts have been brought in from off campus.

The project does not involve RPC particularly. The RPC has a shortage of engineers trained in this field.

University of New Brunswick

1. OBJECTIVES:

UNB is the largest degree granting university in New Brunswick. It offers a wide variety of degree courses at undergraduate level and has a strong commitment to research, both in specific disciplines and taking an interdisciplinary approach. RE Burridge, an academic VP at UNB stated that the University has over the past three years become interested in facilitating transfer of technology to industry, and has an interest in making New Brunswick industry more competitive.

2. SIZE:

1981 external funding for research was $4.29M principally from governments, with a small amount from private industry.

3. AREAS OF EXPERTISE:

There has been an increase in applied science research, often with an interdisciplinary approach. The engineering school is particularly strong in all fields. There are several themes dominant: thermal engineering, CAD/CAM and robotics, nuclear engineering, medical engineering, chemical processing, geological studies, spectroscopy, X-ray crystallography and microscopy, forest nutrition, tree selection. Other strong areas of research include: materials research, transport research, microelectronics research and chemical processing research.

4&5. SPECIFIC PROGRAMS AND CLIENTELE:

External funding for research projects is overwhelming from Federal and Provincial government agencies, notably the NSERC (Natural Sciences and Engineering Research Council) and the SSHRC (Social Sciences and Humanities Research Council).

Materials research--Work for mining and smelting industry; metals recovery; strip metal rolling.

Microelectronics--CADMI Inc. research on autocontroller, fault detector and high voltage work (VLSI); microwave applications for killing potato tips.

Chemical engineering--Material purification and separation, e.g., krypton from off gases of CANDU reactor.

Bioengineering--New Brunswick Hospitals Engineering program ($164,000)

6. NETWORK:

The University is near Provincial and Federal government departments and cooperation between them and UNB is encouraged. The network is formulized through participation in the MTC and CADMI Inc. which brings the University into closer contact with the RPC and N.B. industry.

Universite' de Moncton

Established by an Act of New Brunswick Legislature in 1963. It is set on three campuses.

1. OBJECTIVES:

The Universite' de Moncton is the sole degree granting French language University in the province. It has the following departments in which research is conducted: Acadian research centre; Administrative Science Research Centre; Educational Research; Fine Arts and Applied Arts; Humanities; Social Sciences; Agricultural Science and Biology; Engineering and Applied Sciences; Mathematics and Physical Sciences (including oceanography); Marine Biology; Computer and Information Technology.

2. SIZE:

There were 3,258 full-time and 993 part-time students in 1984/85.

The income for research from external sources according to a 1983 report ("Research Profile of Maritime Post Secondary Institutions) was $1,461,000 (nearest thousand), overwhelmingly sourced from government agencies such as: CRSH (Conseil de Recherche en Sciences Humaines de Canada) MEER (Ministere de l'expansion economique regionale) and CEENB (Commission d'energie electrique de N.B.), CRSNG (Conseil de Rechercher en sciences naturelles et en genie).

3. AREAS OF EXPERTISE:

Please see objectives.

4&5. SPECIFIC PROGRAMS AND CLIENTELE:

Education - $307,000 external research budget (from '83 report). All for Provincial and Federal government departments. The major research projects were "inquiry into the physical condition of Canada" for "the Condition Physique de Canada" ($67,500), three projects exceeding $20,000 for the Education Ministry; 2 projects for the CRSH in excess of $30,000.

- Fine and Applied Arts	- $ 6,900 budget (external)
- Humanities	- $ 16,288 budget (external)
- Social Sciences	- $452,696 budget (external)

Major projects were for MEER and CEENB ($50,000), and for the Donner Foundation ($65,000)

Agricultural Science and Biology (including marine biology). Major projects were for the Agence Canadience de developpement international ($244,236) concerned with nutrition studies for Nicaragua and nutrition and population studies on crabs and lobsters for Approvisionenant et services ($50,000)

Engineering and Applied Sciences	$ 73,000 budget (external)
Major project was for the CRSNG	$ 26,500

Mathematics and physical sciences $245,066 budget (external)
Projects were almost entirely funded by the CRSNG.

Centre de Recharche et Developpement de la Tourbe.
(The Peat Institute)
(see separate report)

6. NETWORK:

There is a wide range of examples of cooperation on projects on several levels - between the university and Federal agencies e.g. DFO.

- Studies financed by Federal and Provincial government (see above)
- Cooperation in studies with industry e.g. the energy commission of N.B.
- MTC (see separate report) Cooperation between University of New Brunswick, RPC, and community colleges and University de Moncton.
- CADMI (see separate report) cooperation between University of New Brunswick and University of Moncton.

Department of Fisheries and Oceans Laboratory
St. Andrew N.B.

1. AGE AND OBJECTIVES:

This Federal department recently celebrated its 75th anniversary. Research and Development work is conducted by 2 main divisions:

1) Fisheries Management Division: aims to ensure the maximum economic and social benefit to Canada from the use of fisheries and other aquatic living resources of coastal and inland water, and to conserve these resources.

2) Ocean Science and Surveys Division: management and development of renewable and nonrenewable ocean resources, and to develop understanding of ecological processes within the aquatic environment and the precautions and remedies required to protect that environment.

2. SIZE:

At St. Andrews there are 30 professional scientists and 70 support staff (approximately).

3. AREA OF EXPERTISE:

Fisheries management: measuring the size of fish populations, forecasting changes and recommending levels of harvesting; carrying out R&D programs upon which advice is based to increase the supply of commercially valuable fish, shellfish, marine mammals and plants; development of fish and shellfish farming methods; and forecasting effects of habitat changes.

4. SPECIFIC RESEARCH:

Specific research projects are conducted in particular areas and particular species, e.g., now researching potential for harvesting a new crab species while maintaining its numbers. Information is needed on size, weight and maturity factors. Also, there is continuation of long-term research, e.g., into natural diets of crabs and lobsters.

5. CLIENTELE:

Much of the work is conducted for the DFO itself. Information is provided to Fisheries Managers who work out the optimum strategy for the fishing industry in terms of harvesting and maintaining stocks. Information is provided to fishing management committees which consist of members of the DFO, the Provincial DFO, and the fishing industry.

Information is also exchanged with other research institutions both nationally and internationally (mainly U.S.A., e.g., Alaska and Maine).

6. NETWORK:

It is a Federal body so it has access to all the resources of the DFO in Canada. There is a degree of cooperation between the DFO and the universities in N.B., although this is not so much the DFO tapping external expertise as the universities provided research assistants, etc. Research into specific DFO topics is subsidized at universities. Joint projects have been conducted.

Huntsman Marine Laboratory (HML)

Founded in 1969

1. OBJECTIVE:

   Huntsman is a research and educational institute specializing in coastal and marine research.

2. SIZE:

   a) Staff - 25 permanent

   b) Budget ($ and sources)

      $1.3m. in '84 sourced from:

      - research grants
      - contracts
      - membership fees
      - donations

      The major source, mainly from Federal and Provincial government but some from private industry.

3. AREA OF EXPERTISE:

   Marine biology - most research is devoted to fish, with a minority concentrating on shellfish.

   Aquaculture

4. SPECIFIC PROGRAMS:

   Research on fishing stocks and relating fish eggs and larvae to future stock levels. Two specific projects presently being researched are:

   a) Aquaculture program that is primarily geared to Salmon, Rainbow Trout and Char including the training of students and technicians in this field. The budget is $150,000.

   b) A project being run jointly with the DFO called the Atlantic Reference Centre. This is a museum type reference collection concerned with fish and invertebrates including larvae and plankton.

5. CLIENTELE:

The Huntsman Marine Laboratory conducts research for the New Brunswick Universities, the Federal and Provincial Department of Fisheries and Oceans. In addition, information and training facilities are offered to a variety of marine consultants in New Brunswick including LGL, Marine Resource Associates and Fundy Isle Marine.

6. NETWORK:

Joint programs and exchange of technical expertise and information occurs between Huntsman Marine, the New Brunswick Universities and the Federal and Provincial Department of Fisheries and Oceans.

Atlantic Salmon Research Center (ASRC)

The Atlantic Salmon Research Center is part of the Atlantic Salmon Federation which is a private non-profit organization.

1. OBJECTIVE:

   The Center is involved in a cooperative program for research in genetics and selective breeding and other aspects in the biology of salmon. Its specific objective is the development of strains of Atlantic Salmon best suited for sea ranching, sea farming and restoration effects.

2. AREA OF EXPERTISE:

   Marine biology, specializing in Salmon breeding (smolt).

3. NETWORK:

   The Center works closely with the Huntsman Marine Laboratory and the Federal Department of Fisheries and Oceans in St. Andrews, the University of New Brunswick in Saint John, the marine laboratory in Halifax, Nova Scotia and the Woods Hole Oceanographic Institute in Massachusetts.

   The Center has developed a local network to small entrepreneurial seafarmers.

Centre de Recherche et Developpement
De La Tourbe
(The Peat Institute)

1. OBJECTIVE:

Research into Peat Moss. There are two basic parts to the research:

a) Test and analysis of peat to help producers identify what peat to produce, analyze the quality of production and other important elements such as humidity; and

b) Investigate new ways to use peat moss.

2. SIZE:

a) Staff: 1 full time PH.D. and 1 technician and 4 to 8 part-time students.

b) Budget ($ and source): Approximately $120,000 p.a. The main source of the budget is Federal and Provincial government. Under the North East Agreement provision was made for a project to fund peat moss research $300,000 over 3 years. 80% is sourced from the Federal Government and 20% from the Provincial Government (approximate figures).

The balance is provided by the peat industry in contract payment for peak research beyond that covered in the main project. There has also been an element of international research involving a feasibility study for production and testing and analysis of peat reserves in Senegal.

3. AREA OF EXPERTISE:

See above

4. SPECIFIC STUDIES:

See above

5. CLIENTELE:

Federal and Provincial Government
N.B. Peat Industry
Senegal

6. NETWORK:

Located on one of three campuses of the University de Moncton and all studies related to peat moss in N.B. are carried out at this one location. Technical assistance has been sought from the NRC and RPC.

TABLE C-1

GROSS DOMESTIC EXPENDITURES ON R&D PER EMPLOYEE BY REGION

Province	Total Employment 1983 (000)	Total Domestic Expenditures R&D 1982 ($M)	Total Domestic Expenditures Per Employee $	Sources of Funds ($000)		
				Government	Industry	University and Private Non-Profit
Newfoundland	174	51	293	29	1	21
Prince Edward Island	48	6	125	6	-	-
Nova Scotia	320	110	344	62	10	38
New Brunswick	247	52	210	28	5	19
Quebec	2,642	973	368	139	559	275
Ontario	4,096	2,348	573	648	1,349	351
Manitoba	460	156	339	85	26	45
Saskatchewan	436	114	261	35	38	41
Alberta	1,115	474	425	103	255	116
British Columbia	1,197	290	242	76	122	92
Canada	10,734	4,591	428	1,212	2,381	998

TABLE C-2

Person-years involved in natural science activities total 184. This is approximately 1.7% of the total N.B. Government person-years. Categories identified are scientific and professional, technical and other.

Personnel Engaged in N.B. Government Scientific Activities, by Category and Department or Agency, 1983-84

Department or Agency	Scientific and professional	Technical	Other	Total scientific personnel	Total Personnel(1)	Scientific to total personnel
	(person-years)					%
Agriculture	17	3	3	23	356	6.5
Commerce and Development	17	1	2	20	122	16.4
Energy Secretariat	1	1	4	6	11	54.5
Environment	6	8	1	15	94	16.0
Fisheries	14	1	4	19	99	19.2
Natural Resources	32	19	32	83	814	10.2
Other	10	5	3	18	8,992	0.2
Total	**97**	**38**	**49**	**184**	**10,765**	**1.7**

(1) "Main Estimates, 1984-85", New Brunswick, Catalogue Number ISSN 0700-2467.

Source: "Scientific Activities of New Brunswick 1983-84 Survey Results, Statistics Canada 1984"

TABLE C-3

Indicators of Provincial Scientific Activities

Gross Domestic Expenditures on R&D in Canada, by Performing Sector, by Region, 1982(1)

Province	Federal Government	Provincial government	Provincial research organizations	Total government	Industry	University	Private non-profit	All sectors
	($000,000)							
Newfoundland	28	1	-	29	1	21	-	51
Prince Edward Island	6	-	-	6	-	-	-	6
Nova Scotia	58	1	3	62	10	38	-	110
New Brunswick	**26**	-	2	**28**	**5**	**19**	-	**52**
Quebec	107	23	9	139	559	261	14	973
Ontario	588	48	12	648	1,349	325	26	2,348
Manitoba	82	1	2	85	26	43	2	156
Saskatchewan	28	3	4	35	38	41	-	114
Alberta	59	23	21	103	255	114	2	474
British Columbia	59	13	4	76	122	91	1	290
Canada(2)	1,042	113	57	1,212	2,381	953	45	4,591

(1) **"Gross Domestic Expenditures on R&D, By Region, 1979-1982"**, Science and Technology Statistics Division, Statistics Canada.
(2) Includes the Yukon and Northwest Territories.
NOTE: Totals may not add due to rounding.

Source: "Scientific Activities of New Brunswick 1983-84 Survey Results, Statistics Canada 1984"

TABLE C-4

Indicators of Provincial Scientific Activities

Gross Domestic Expenditures on R&D in Canada, by Funding Sector, by Region, 1982(1)

Province	Federal Government	Provincial government	Provincial research organi-zations	Total govern-ment	Industry	Univer-sity	Private non-profit	All sectors(3)
	($000,000)							
Newfoundland	35	2	-	37	1	11	2	51
Prince Edward Island	6	-	-	6	-	-	-	6
Nova Scotia	77	2	-	79	9	21	-	110
New Brunswick	35	2	-	37	5	10	-	52
Quebec	252	78	1	331	444	128	23	973
Ontario	873	116	1	990	1,082	116	44	2,348
Manitoba	105	8	-	113	21	14	5	156
Saskatchewan	46	10	-	56	31	23	1	114
Alberta	115	76	-	191	203	54	5	474
British Columbia	110	21	-	131	99	43	6	290
Canada(2)	**1,655**	**313**	**3**	**1,971**	**1,908**	**421**	**86**	**4,591**

(1) "Gross Domestic Expenditures on R&D, By Region, 1979-1982", Science and Technology Statistics Division, Statistics Canada.
(2) Includes the Yukon and Northwest Territories.
(3) Includes foreign sources of funds.
NOTE: Totals may not add due to rounding.

Source: "Scientific Activities of New Brunswick 1983-84 Survey Results, Statistics Canada 1984"

TA.... C-5

HIGHLIGHTS

During the 1983-84 fiscal year N.B. Government expenditures on scientific activities in the natural sciences were equal to $15.0 million. This is 0.5% of the total budgetary expenditures of the government for that year.

N.B. Government Expenditures

Department or Agency	1983-84			1984-85		
	Total revised expenditures(1)	Total natural science expenditures	%	Total estimated expenditures(1)	Total estimated natural science expenditures	%
	($ millions)		%	($ millions)		%
Agriculture	24.7	0.9	3.6	22.2	1.0	4.5
Commerce and Development ...	16.3	4.5	27.6	15.5	13.3	85.8
Energy Secretariat	6.2	2.8	45.2	4.1	2.7	65.8
Environment	13.7	0.7	5.1	13.9	0.6	4.3
Fisheries	10.3	1.0	9.7	9.7	1.4	14.4
Natural Resources	41.3	4.0	9.7	38.8	4.4	11.3
Other	2,256.2	1.1	--	2,391.6	0.8	--
Total	**2,368.7**	**15.0**	**0.5**	**2,495.8**	**24.2**	**0.8**

(1) "Main Estimates 1984-85", New Brunswick, Catalogue Number ISSN 0700-2467.

Source: "Scientific Activities of New Brunswick 1983-84 Survey Results,

Statistics Canada 1984"

TABLE C-6

Of the total 1983-84 N.B. Government science expenditures ($15.0 million), $5.6 million is spent on research and development. Major support of research and development comes from the Departments of Commerce and Development and Natural Resources. The Special Services and Studies activity is the major related scientific activity, supported mainly by the Energy Secretariat.

The provincial government itself performed 25% of R&D activities and 65% of related scientific activities in 1983-84. The remainder is performed extramurally. Industry is the largest extramural performer, receiving $4.3 million in support of science.

N.B. Government Expenditures on Science, by Activity and Performer, 1983-84

Activity	Intramural	Industry	Universities	N.B. Research and Productivity Council	Other	Total
	($ millions)					
Current expenditures:						
Research and Development	1.4	2.3	0.4	0.7	0.7	5.6
Education support	0.2	-	0.3	--	-	0.5
Technical surveys	3.5	0.2	--	-	--	3.8
Information services	0.7	0.2	--	--	--	0.9
Special services and studies	1.6	1.6	0.1	0.1	0.5	3.9
Museum services	0.1	-	-	-	-	0.1
Sub-total	7.5	4.3	0.8	0.9	1.3	14.8
Capital expenditures:						
Research and development	0.1	NA	NA	NA	NA	0.1
Related scientific activities	0.1	NA	NA	NA	NA	0.1
Sub-total	0.2	NA	NA	NA	NA	0.2
Total	**7.7**	**4.3**	**0.8**	**0.9**	**1.3**	**15.1**

Note: Totals may not sum due to rounding.

In this report the scientific expenditures of the New Brunswick Research and Productivity Council reflect only the yearly grant from the New Brunswick government. Additional information on the New Brunswick Research and Productivity Council is available in Science Statistics, Catalogue No. 88-001, Vol. 8, No. 11.

Source: "Scientific Activities of New Brunswick 1983-84 Survey Results, Statistics Canada 1984"

TABLE C-7

Government of New Brunswick

Total Expenditures in the Natural Sciences, by Activity and Performer, 1983-84

Activity	Intramural	Industry	Universities	Hospitals & health organizations	N.B. Research & Productivity Council	Other	Total
	($'000)						
Research and development:							
In-house	970	NA	NA	NA	NA	NA	970
Contracts	374	2,247	164	-	110	172	3,067
Grants	62	36	270	-	634	526	1,528
Research fellowships	-	-	-	-	-	-	-
Sub-total	1,406	2,283	434	-	744	698	5,565
Related scientific activities:							
Education support	178	-	268	-	33	-	479
Technical surveys	3,485	252	11	-	-	96	3,844
Information services	666	217	6	-	29	16	931
Special services & studies ..	1,644	1,555	109	-	136	465	3,909
Museum services	88	-	-	-	-	-	88
Sub-total	6,061	2,024	394	-	195	577	9,251
Capital expenditures:							
Research & development	137	NA	NA	NA	NA	NA	137
Related scientific activities	103	NA	NA	NA	NA	NA	103
Sub-total	240	NA	NA	NA	NA	NA	240
Total	**7,707**	**4,307**	**828**	-	**939**	**1,275**	**15,056**

Source: "Scientific Activities of New Brunswick 1983-84 Survey Results, Statistics Canada 1984"

TABLE C-8

Objectives of N.B. Government Natural Science Expenditures, by Department or Agency, 1983-84

Department or Agency	Advancement of science	Energy & fuels	Environmental issues	Health	Industrial & economic development	Social development & related areas	Other	Total
	($ millions)							
Agriculture	-	-	-	-	0.9	-	-	0.9
Commerce and Development	2.1	0.4	-	-	1.1	0.6	0.3	4.5
Energy Secretariat	-	2.8	-	-	-	-	-	2.8
Environment	-	-	0.7	-	-	-	-	0.7
Fisheries	-	-	-	-	1.0	-	-	1.0
Natural Resources	-	-	-	-	4.0	-	-	4.0
Other	0.1	-	0.1	0.4	0.2	0.1	0.2	1.1
Total	**2.2**	**3.2**	**0.8**	**0.4**	**7.2**	**0.7**	**0.5**	**15.0**

Note: Totals may not sum due to rounding.

Source: "Scientific Activities of New Brunswick 1983-84 Survey Results, Statistics Canada 1984"

APPENDIX D

INSTITUTIONAL CONTEXT

APPENDIX D

POLICY AND INSTITUTIONAL CONTEXT FOR SCIENCE AND TECHNOLOGY STRATEGY

A. FEDERAL POLICY CONTEXT

Canadian economic policy, both at the Federal and Provincial level, has traditionally placed priority on economic development and job creation for a relatively fast growing population. In more recent years, the Federal Government has also placed priority on promoting economic expansion in the more economically depressed regions of the country. Economic development has been promoted through a combination of taxation incentives and financial assistance programs which, in their totality, create one of the most attractive financial environments for manufacturing, processing and research and development activities in the industrialized world.

Federal tax incentives and financial assistance are more generous for the lower income regions of Canada, such as New Brunswick, than for higher income regions such as Alberta and Southern Ontario. In recent years, this has been in part offset by the Provincial Governments of the economically-advantaged provinces who have lowered Provincial corporate tax rates for Canadian-controlled small business and introduced Provincial programs to help finance plant investment on favourable terms (particularly for small businesses) and to provide technical assistance in training, marketing and through consulting assistance funds.

1. Corporate Tax Regime

Canadian tax authorities claim that the Canadian corporate tax regime governing manufacturing, processing and research and development activities is more generous than in most other industrialized countries. We have not had opportunity to carry out such an international comparison for this assignment; but based on our knowledge of the tax structures in Japan, the United States, and Western Europe, the Canadian system appears favourable, particularly for manufacturing and processing companies in a start-up or expansionary phase with a research and development orientation.

The major features of the Canadian corporate tax regime are presented in Table D-1.

An important feature of the Canadian fiscal regime to note is that the research and development tax credits are treated as taxable income in the year claimed. Another important factor is that investment tax credits are determined on the total expenditure and any grants received are not deducted. Investment tax credits are considerably higher for Canadian-controlled small business and for investments in

TABLE D-1
MAJOR FEATURES OF CANADIAN CORPORATE TAX REGIME

	Federal	Provincial		
		Alberta	Ontario	New Brunswick
1. Corporate Tax Rates (3)				
Manufacturing/Processing				
- Canadian-controlled small business (1)	10%	5%	10%	9%*
- Other	30%	11%	14%	14%
Other Industry				
- Canadian-controlled small business	15%	5%	10%	9%*
- Other	36%	11%	15%	14%
2. Small Business Dividend Distribution	12.5%			
3. Capital Cost Allowance Plant & Equipment				
First Year	25%	25%	50%	50%
Second Year	50%	50%	50%	50%
Third Year	25%	25%		
R&D (2)	100%	100%	100%	100%

4. Investment Tax Credit

	R&D	Manufacturing Plant & Equipment
Base	20%	7%
Atlantic Provinces & Gaspe	30%	20%
Canadian-Controlled Small Business	35%	-
Areas Under Regional Development Incentives Act (4)	50%	10%, 50%

Note: R&D Investment tax credits are added to taxable income in year claimed.

(1) The first $200,000 of taxable income of all Canadian-controlled companies is taxed at the small business rate.

(2) An additional deduction is available for 50% of the increase in R&D expenditure over the average level of the previous three years. R&D current and capital expenditures also qualify for investment tax credits.

(3) The May 1985 Budget introduced a temporary surtax of 5% on federal income tax payable, with the exception of tax on income qualifying for the small business tax rate, for the period (July 1, 1985 to June 30, 1986.)

(4) This special investment tax credit introduced in 1980 was to have expired December 31, 1985. The May 1985 Budget extended it for one full year.

* (currently suspended)

Development Incentives Act than are the tax credits available for investments by large Canadian companies or the Canadian subsidiaries of foreign companies in other regions.

Capital cost allowance provision (CCA's) allow depreciation of plant and equipment over 2 to 3 years and all expenditures on research and development in the year incurred. For companies in a taxable position, this when combined with investment tax credits leads to a major reduction in the effective cost of an investment; and for non-taxable companies postponing when they will have to pay corporate income taxes. This is illustrated in Table D-2 where we present a hypothetical comparison of the tax positions of a Canadian-controlled small firm and a large firm, located in either Alberta, Ontario, or New Brunswick. For the purpose of illustration, we have assumed taxable income to be 10 percent of sales and R&D expenditures to total 8 percent of revenues.

Federal corporate income tax rates for manufacturing companies are 20 percent for small Canadian-controlled manufacturing companies and 40 percent for other manufacturers. There is an abatement provision of 10 points for Provincial corporate taxes which reduces the effective Federal rates to 10 and 20 percent respectively. With the February, 1984 budget, the first $200,000 of taxable income of all Canadian-controlled companies is now to be taxed at the lower rate. The May 1985 Budget has introduced a temporary surtax of 5 percent on Federal income tax payable, with the exception of tax on income qualifying for the small business tax rate, for the period July 1, 1985 to June 30, 1986. These rates compare favorably with corporate tax rates in other countries.

2. Government Financial Assistance

The Federal and Provincial Governments in Canada have many programs designed to aid Canadian industry, ranging from assisting in the financing of plant and equipment, to providing required infrastructure (e.g. roads) to supporting export promotions. The Federal Government programs are the main vehicles for providing financing and other support assistance to industry. The ongoing Ministerial Task Force on Program Review has identified 172 Federal programs providing services and subsidies to business, costing in aggregate some $11.2 billion per year.

The Federal Government provides financial assistance in many forms: grants; expenditures contributions; loans and loan guarantees. The Task Force has expressed concern over the complex ad hoc system in place at present and in particular, that an investment project can 'stack' support from various Federal and Provincial programs along with corporate tax incentives to the point where the private investor is putting up a relatively small percentage of the total investment.

TABLE D-2
CORPORATE TAX LIABILITY FOR CANADIAN MANUFACTURER WITH R&D ACTIVITIES

	Canadian-Controlled Small Firm	Canadian-Controlled Large Firm
Sales	$5,000,000	$50,000,000
Taxable Income Before R&D Consolidation	500,000	5,000,000
Deduct 100% R&D Expenditure	(400,000)	(4,000,000)
Add R&D Investment Tax Credit		
Alberta	140,000	800,000
Ontario	140,000	800,000
NB - RDIA	200,000	2,000,000
NB - Other	140,000	1,200,000
Taxable Income		
Alberta	240,000	1,800,000
Ontario	240,000	1,800,000
NB - RDIA	300,000	3,000,000
NB - Other	240,000	2,200,000
Tax Liability Before Investment Tax Credit		
Alberta	46,400	686,000
Ontario	57,600	744,000
NB - RDIA	87,000	1,270,000
NB - Other	55,600	918,000
Tax Liability After Investment Tax Credit		
Alberta	-	-
Ontario	-	-
NB - RDIA	-	-
NB - Other	-	-

Note: For the period 4/83 to 6/86, companies not in a position to use their tax credits are able to claim a refund from the federal government on a portion of them: 40% for small Canadian-controlled companies, and 20% for all other businesses. In the May 1985 Budget, it is proposed that the tax credit earned by small Canadian-controlled private corporations for current expenditures on R&D be made 100% refundable. This will not be subject to expiry.

The Department of Regional Industrial Expansion (DRIE) has primary federal responsibility for economic development. It was formed in 1983 with the merger of the Departments of Industry, Trade and Commerce (ITC) and Regional Economic Expansion (DREE). A number of ITC and DREE financial assistance programs were combined and supplemented in the new Industrial and Regional Development Program (IRDP) which is now the federal government's principal program of financial assistance to industry. This program is focused on manufacturers and processing industries with the greatest support available in the economically-disadvantages areas. This in turn reflects the Federal Government's policy to reduce the economic disparity between regions.

Canada's census regions have been ranked by a development index based on their level of unemployment (10 points), per capita income (50 points) and the Provincial fiscal capacity (40 points) to determine their national level of support. There are four support tiers starting from a basic national level for which all qualifying Canadian companies are eligible, to economically depressed areas designated Tiers 3 and 4. Most of New Brunswick's regions are in Tiers 3 and 4.

The IRDP is 'aimed at projects, industries and technologies with the greatest potential for economic return, sustained growth and international competitiveness'. In practice, there does not appear to be any hard and fast ranking criteria. DRIE officials state that the IRDP is sector neutral and emphasized that the IRDP is directed to providing incremental rather than base financing to ensure that viable projects go ahead which, in the absence of federal assistance, would not. The proposal decline rate in New Brunswick is reported to be in the order of 50 percent for projects with an innovation component as compared to 70 percent for Ontario proposals. While there are maximum levels of assistance for the different elements of the IRDP, the actual level of assistance granted is negotiated between the project sponsors and DRIE. DRIE takes into account the contributions from other federal and provincial assistance programs and the after-tax cost of the proposed investment in determining the support it will offer.

DRIE has been tightening up on what has been a rather generous system of grants; and in November, 1984, major revisions to the program were introduced. Maximum grant ceilings in most instances have been cut by one-third. A number of changes to the evaluation process were also introduced, including automatic maximum sharing ratios for smaller projects which meet program criteria and regionalized decision-making and program deliver for many projects. A summary of the various elements of the IRDP are presented in Table D-3.

TABLE D-3

INDUSTRIAL AND REGIONAL DEVELOPMENT PROGRAM

Program Description	Maximum Level of Assistance			
	Tier 1	Tier 2	Tier 3	Tier 4
	(Percentage of Cost Contributed)			
Innovation				
To encourage development of new products, new processes and improve productivity through R&D, 5 programs	33.3	40.0	50.0	50.0
Establishment				
To assist in establishment of new facilities in economic disadvantaged regions				
a. Studies of project feasibility, market research, etc.	N/A	30.0	37.5	37.5
b. Plant establishment	N/A	17.5	25.0	30.0
Modernization/Expansion				
To increase industrial productivity				
a. Studies	N/A	30.0	37.5	37.5
b. Modernization	N/A	17.5	25.0	25.0
c. Expansion	N/A	17.5	25.0	25.0
d. First Installation of micro electronic devices	N/A	30.0	37.5	37.5
Marketing				
a. Promotion	45.0	45.0	45.0	45.0
b. Studies	25.0	30.0	37.5	37.5

The development index ranking is important for IRDP. The program of support for projects in the less-developed regions is generous by international standards, but close to the Canadian norm for the economically advantaged regions. Tier 1 regions, for example, do not qualify for assistance in the establishment of new production facilities. For projects with a high technology component, the Tier classification is not that important a factor in location choice as even Tier 1 projects qualify for support under the Innovation Program of up to 33.3 percent (previously 50 percent) as compared with 50 percent (previously 75 percent) in Tiers 3 and 4. Possibly of more importance are the differences in the levels of R&D tax credits between regions, with expenditures on R&D qualifying for a 30 percent tax credit in the Atlantic Provinces and the Gaspe and a 50 percent tax credit in Areas Under the Regional Development as compared with a base rate of 20 percent. (Table D-1)

The Federal Government through the Small Business Loans Act and the Federal Business Development Bank (FBDB) also provides loans and loan guarantees to businesses in instances where normal commercial financing is not available. The FBDB also invests in high-risk companies. (There are also a number of Provincial bodies assisting industry with debt financing and in some instances equity funds. As with the Federal programs, these are largely directed to assisting small companies).

Export marketing is assisted through the Federal Government's Program for Export Market Development. Exports are also supported through the Export Development Corporation which provides export financing and insurance.

The more important federal programs are summarized below:

1. IRDP - Innovation (DRIE) - outlined in Table D-3.

2. Industrial Research Assistance Program administered by the National Research Council (NRC). There are a number of sub-programs, but for the most part, IRAP funds up to 50 percent of the budget (including salaries) of relatively small R&D projects. The IRAP programs have been well received by industry.

3. Defense Industry Productivity Program, administered by DRIE, is directed at Canadian-based companies undertaking defense-related R&D. DIP normally provides 50 percent of program costs.

4. Program for Industry/Laboratory Projects (PILP) administered by NRC, to promote transfer of technology from Government research for Canadian industrial expansion.

5. Microelectronics Support Program (IRDP). The federal contribution can be up to 37.5 percent of eligible costs.

6. New Technology Employment Program administered by the Canada Employment and Immigration Commission (CEIC) to provide salary assistance to small firms, research institutions, crown corporations, etc., to hire post-secondary graduates, up to 75 percent of wages to a maximum of $290/week.

7. Critical Trade Skills Training (CTST) to train workers for high skill occupations where there are shortages such as system analysis, robotics programs and electronics technicians (up to 50 percent).

B. PROVINCIAL POLICY CONTEXT

The goals and objectives of the Provincial Government can be summarized by two broad strategies: the provision of quality employment opportunities and raising of living standards of New Brunswick residents; and the strengthening of the fiscal position of the government and its capacity to provide public services. These in turn have to be viewed in the context of the Federal Government's broad regional development objective of reducing regional disparities in Canada as to economic opportunities, standard of living and quality of Government services.

The strategic policy thrusts of the Provincial Government relate to both industrial and geographic themes. In the industrial development context, government policy is to strengthen and diversify the existing economic base; to increase the level of resource processing; and to increase non-resource-based economic activity. In the geographic context the main policy thrust is to promote the development of viable and diversified regional economies. The Provincial Government has also identified a number of key support strategies, notably:

- The development of supporting educational research and training infrastructure;
- Resource management; and
- Promotion of industrial innovation.

Government action and initiatives to date have been dominated by shorter-term employment considerations and industry support requirements; and the priority in terms of funding has been focused on the traditional resources industries.

Overall, there has not been much success to date in diversifying the New Brunswick economy. While there appears to be considerable opportunity to further process New Brunswick's primary resources, especially in wood products, fish processing and smelting, this has been happening at a very modest pace. In the non-resource related industries, there have been difficulties in attracting inward investment although considerable effort has been expended in the past. There have also been several prominent failures such as Bricklin and Mitel. This experience appears to have led to a lower priority being placed on attracting large, new projects to the Province and higher priority to supporting existing industries and fostering growth of NB-based companies. Here too there have been mixed results with a common complaint/concern voiced that companies were being promoted by both levels of government to expand beyond their capabilities or at too fast a pace; and that after the initial injection of funds there were no continuing technical and financial support programs to help them move bejond the initial start-up or expansion phases.

The level or terms of financial assistance and the fiscal system do not appear to have been a constraint to promotion of inward investment. We are not in a position, however, to assess how effective both levels of Governments have been in tailoring their programs to meet the location selection criteria of targeted companies; or indeed to evaluate the process of selection of industries and companies to be approached.

An effective economic development program, of course, encompasses many factors in addition to government financial assistance and fiscal incentives. This is particularly the case for new or small companies, which in most instances will need to be competitive in other Canadian and export markets to survive and grow. Such companies often are in greater need of technical assistance services than financing (eg. marketing, financing, plant and inventory cost control systems etc.) Our perception is that while there are Federal and Provincial programs in place to provide such services, they are not being provided at the level required. We believe that a strong case could be made for the reallocation of public funds to provide less financial assistance to larger corporations and more financial and technical assistance to smaller Canadian companies in growth industries.

Resource management of New Brunswick natural resources has increased in priority, reflecting the resource constraints that are now limiting resource industry activities, notably in forestry, pulp and paper and fishing. Important initiatives have been taken, e.g. the Crown Lands Act to manage New Brunswick forests and research to increase ore recovery rates. Both Government and private sector representatives have observed that recent initiatives, while important, are somewhat modest relative to the magnitude of the resource problem.

The development of research facilities in New Brunswick has not been a priority for either Federal or Provincial Governments. The Province has limited science and technology capabilities to support industrial innovation in existing industry or support technology-driven inward investment. Moreover, the technology engines present in the Province have not spun out very many new venture opportunities.

There has been considerable effort made to develop the educational system of New Brunswick; and it would appear adequate to support the economic development objectives of the Province. The New Brunswick educational system appears to be responsive to industry requirements. There is evidence of this in the cooperation of the community colleges in 'customizing' course work for specific industry demands and in the two major universities where new courses of study have been introduced to enhance the employment opportunities of their graduates. Given the small size of the province, however, special training programs will undoubtedly have to be mounted and recourse made to external labor markets to meet the needs of larger, more technical, investment projects.

Overall, the New Brunswick economic development strategy is consistent with those of other Canadian Provinces with one major exception; the relatively low priority placed on development of high-tech industries. The Federal Government's development philosophy, and Federal funding programs, appear to be a more dominant factor in New Brunswick's development strategy than elsewhere, certainly more so than in the more economically advantaged provinces. The most important explanatory factor would appear to be the extensive reliance on Federal funding of Provincial development programs. The private sector in New Brunswick also appears to have a more limited role in New Brunswick's economic development strategy than, for example, in Alberta or Ontario. While there has been extensive government-industry consultation, we were not able to identify examples of joint industry-government initiatives and the responsibility for economic development clearly rests solely with the two levels of government.

New Brunswick has lagged behind other Canadian provinces in developing a comprehensive Science and Technology Strategy. Political commitment to Science and Technology is less strong than in most other provinces. Consistent with this, most other Provinces have a much better defined Science and Technology focus, which in turn is reflected in the institutional and financial resources they have committed to supporting science and technology, the closer institutional linkages and the attention to the interface with the community.

The economically advantaged Provinces of Canada have pursued S&T strategies independent of the Federal government, in for the most part reflecting the absence of Federal technology policy guidelines for many years and also the competitive nature of provincial economic development strategies. Quebec and Ontario have led the way and have reasonably comprehensive programs in place to support technological transfer and innovation. Both have made it a priority to support new technology ventures. Alberta, Saskatchewan, Nova Scotia, Manitoba have also now in place a reasonably comprehensive array of support programs and institutions. British Columbia has recently announced a number of initiatives (eg. a new Venture Capital Assistance Program, (tailored after Ontario's SBDC program) and Special Enterprise Zones) designed to put British Columbia on an equal competitive footing with other Canadian provinces as an investment location.

Provincial Science and Technology initiatives can be grouped in the following manner:

1. Industrial Development Corporations: Quebec, Alberta, British Columbia, Saskatchewan Nova Scotia, Ontario
2. Technology Assistance Programs: Quebec, Ontario, New Brunswick, Manitoba
3. Technology Centers: Quebec, Ontario, New Brunswick, Alberta, Manitoba, Nova Scotia
4. Science Parks/Innovation Centers: Alberta, Saskatchewan, Nova Scotia, B.C., Manitoba, Ontario
5. Venture Capital Corporations: Alberta, Nova Scotia, Manitoba, Saskatchewan B.C., New Brunwick, Ontario, Quebec

It is difficult to make a comparative assessment of the effectiveness of different provincial programs. Many of these initiatives are of recent vintage and there is not a track record on which one can evaluate performance. Moreover, some of the older programs have been adapted and retargeted to reflect changing government priorities and to better meet the needs of the research and business communities. Provincial programs also have to be reviewed in the context of the economic situation in the Province, its overal technological sophistication, Provincial fiscal capacity and the political philosophy of the Provincial Government. One noticeable trend is the shift away from grants towards loans on favorable terms, tax credits and improving the capital base of small and medium size businesses (e.g. small business development corporations).

Notwithstanding the above qualifications, it is clear that New Brunswick has not placed priority on developing its research institutes or attracting new research institutes to the province. It has lagged behind other provinces in developing programs and institutions to promote and support technological innovation and new technology-intense business ventures. In contrast, in support of technology transfer, given the important contribution of the Research and Productivity Council, it probably should be ranked above average. The MTC and CADMI initiatives may over time also make an important contribution to the required technology upgrading of New Brunswick industry. It is important to note that these successes have been initiated at the Provincial level and we think illustrate the importance of the Province taking the initiative in Science and Technology and not waiting to ride Federal initiatives.

APPENDIX E

REGIONAL PANELS AND WORKSHOPS

APPENDIX E

REGIONAL PANELS AND WORKSHOPS

A series of panel discussions and workshops were held around the Province to gather a wide cross-section of information and input on strengths, weaknesses, opportunities, and priority needs, at the beginning of the process of developing the Science and Technology Strategy. Typically, each panel was comprised of 10 to 12 people representing business, labor, education, research institutions, and government. In all, over 200 individuals provided input to the strategy process through these panels.

Panels were held in St. John, St. Andrews, Fredericton, Edmonston, Moncton, New Castle/Chatham, Bathurst, Shippegan/Caraquet and Cocagne--in some cases providing a regional focus, in other cases an industry focus. The outputs from these sections are summarized in this Appendix. After the preliminary strategy was developed, the panels were reconvened to obtain their reaction and suggested refinements. The results of the second series of panels have been incorporated into the Science and Technology Strategy described in the main body of this report.

A. STRENGTHS AND WEAKNESSES

The following strengths and weaknesses of science and technology-related economic development activities were identified by the panels:

o Strengths

- Maritime sciences in St. Andrews
- Research and Productivity Center, particularly in mining, mineral processing, energy and food sciences
- University of New Brunswick, particularly in engineering
- MTC, CADMI and selected research capabilities at Udem,
- Forestry research capabilities,
- Large number of consulting firms,
- Technological sophistication of several large companies and New Brunswick Power and New Brunswick Telephone,
- Strong community college training programs in some areas,
- Examples of some successful spin-off companies,

- Generally good reputation of application and use of IRAP, and
- the Peat Research Institute

o **Weaknesses**

- Low relative investment in R&D,
- Conservatism and resistance to technological change--this is perceived to be particularly strong in the Maritimes,
- Difficulty in raising private investment capital and the scarcity of high-risk seed capital,
- Lack of widespread awareness of available incentive programs and a lack of integration of same programs
- Inadequate mechanisms to consistently evaluate technology projects applying for public funding,
- Duplication and diffusion of science and technology efforts compounded by critical mass problems,
- Difficulty in recruiting and retaining scientific talent in New Brunswick,
- Narrow technology base combined with a narrow industrial base, and
- Lack of continuing support for student and faculty projects within universities

B. NEEDS AND OPPORTUNITIES

As a context for pursuing New Brunswick's Science and Technology goals and objectives, the technology-related needs and opportunities throughout the Province must provide the framework for action. At the panels, the following were cited as priorities to be addressed by New Brunswick's Science and Technology strategy:

o **Needs**

- Better use of Science and Technology resources, within and outside of New Brunswick (this priority was reemphasized during the course of follow-up panels);
- More focused application of available financial assistance resources, increased emphasis on follow-up;

- Strengthened technical assistance, particularly in the areas of business planning and marketing to complement the financial assistance provided by the Federal and Provincial governments;

- More supportive climate for entrepreneurial development;

- Increased private sector participation in Provincial strategy;

- Strengthened educational resources at all levels; and

- Better utilization of the labor force ;

- Improved transportation infrastructure and expanded service; and

- Improved exploitation of New Brunswick's quality of life.

- o Opportunities

  - Development of new and expanding markets for existing industries;

  - Development of new products and new businesses associated with technology application to New Brunswick's natural resources (e.g., salmon farming, aquaculture);

  - Development of value-added and supplier-sourcing opportunities in the production of new products related to New Brunswick's natural resource base (e.g., specialty furniture, flooring and paneling, machinery for pulp/paper machinery, wood products);

  - Development of new products and new businesses associated with high technology industries (e.g., computer software, silicon wafers); and

  - Attraction of investment into New Brunswick.

Science and Technology Transfer Mechanisms

Strengthened technical resources are needed in three key areas: forestry and related wood products; fisheries, agriculture and food processing; and mining.

Although various technology transfer mechanisms exist throughout the Province, they are uneven in their effectiveness and their applications not well understood. The perception of the effectiveness of RPC differs significantly from region to region and technology area to technology area. There is little awareness by industry of MTC or CADMI, especially in more remote regions of New Brunswick. MTC/CADMI are both perceived by some firms to lack direction and strong management. Many firms complained of a lack of information on available technical expertise.

There appears to exist among businesses a general fear or uncertainty of "technology", itself. Many are unsure of its implications for their businesses and jobs. There appears to be a need for greater emphasis on applications of technology at universities, RPC, MTC, and CADMI; many feel the present emphasis on basic research is too heavy.

Overall, there is an absence of effective channels of access by companies and individuals to technology-related information and expertise. The development of industry specific initiatives are needed in: forestry, fishing, and mining and energy.

Establishment of a concentration of Forestry research management expertise in Fredericton is an important step in achieving a strong concentration of timber products research expertise tailored to New Brunswick's species of resources. The principal emphasis will be on resource management technologies. Establishing a complementary expertise in downstream product and process technologies at the Forestry research institutions in Fredericton should also be considered. There is a need for an "advocate" for the forest products resource and related manufacturing industries. An "advocate" body should be established as a focal point for access to forestry related technology expertise--both for New Brunswick industries and internationally.

Similarly, an advocate and central focal point needs to be established for fishing and marine industries. At present, no such group exists. Within New Brunswick and the Maritimes, a number of research institutions are, however, doing work with several emerging technologies, many with relevance to New Brunswick's fisheries resource. Of particular interest are the technologies being pursued in salmon smolting, fish farming, and aquaculture in the three research institutions and several start-up ventures in St. Andrews and in mussel farming along the East Coast. These institutions have established strong working relationships with counterparts in Nova Scotia, elsewhere in Canada and beyond (notably, the Woodshole Oceanographic Institute in Massachusetts). However, despite this strength, there is no single organization which acts as an advocate for the new industry or provides an effective link between the St. Andrew's and East Coast research institutions and fish-related interests. Creating a link between fisheries research expertise and the fish processing and fish cultivation industries is a vital priority.

Finally for mining and materials-related resources, there is the need for a technology advocacy organization. This can build upon the research and technology expertise at RPC--the Center receives high marks from industry in nuclear power technology and some aspects of mining technology. In peat, the Peat Research Institute affiliated with the Universite' de Moncton in Shippegan has also received high marks for providing assistance in developing and applying peat-related technologies.

Financial Assistance

Financial assistance programs, while in abundance, do not appear to be effectively or consistently targeted to priority opportunities. These represent a confused and controversial topic--one company representative said he knew of 300 Provincial assistance programs and another said that if both Provincial and Federal programs were included they would number 2000. Targets of application for funding programs are perceived to change frequently. Businesses believe that most programs provide either funding for upfront "injections" of capital or bail-out before bankruptcy, but nothing in between. There appear to be little or no funds for "developing an idea," rather, funds are for purchasing equipment and funding processing operations in manufacturing industries. They are not for supporting business functions such as marketing, or for related technology investments such as software, and are not for applying technologies in non-manufacturing sectors such as tourism.

Many companies admitted being too accustomed to receiving government grants. Private venture capital is in short supply, particularly for investment in New Brunswick facilities (several firms noted that they could attract venture capital for expansions in other provinces or the states. As many companies consider securing bank loans or debt capital, they use government grants as part of their equity base. Many programs are perceived to be falsely advertised in terms of amount of funding and timing (especially IRDP)--many firms have experienced long delays, much paperwork and political difficulties. This problem was recognized in the November revision to the IRDP and maximum loan ceilings have been substantially reduced to bring them more in line with the levels of funding actually provided. Some concern has been expressed regarding the qualifications of people screening applications. Only two programs were praised--IRAP [NRC funded, administered through RPC] and SIFAP [DRIE funded, administered by Province].

Overall, businesses believe financial assistance should be streamlined and focused. Businesses frequently questioned whether large businesses should get large amounts of financial assistance. Many felt that more should be directed to small businesses.

Management Assistance

A full complement of management assistance programs is perceived to be absent, particularly in business planning and marketing. While the New Brunswick Department of Commerce and Development has a mandate to provide such services, funding allocations have limited their ability to deliver. Regional development commissioners provide some assistance, but have no where to go for help themselves. RPC, universities and government groups do not have a solid capability. Neither CMA nor local chambers have been providing such assistance. This is perhaps the largest void in New Brunswick today.

There are several existing but modest building blocks upon which a more comprehensive program can be built, particularly the UNB business school (faculty and classes offered at Fredricton and St. John), U de M, the community colleges, the Federal Business Development Bank, the local chambers and regional commissioners. A solid base of expertise needs to be established, together with an effective network through which businesses and individuals can access it.

Private Sector Participation

Generally, the private sector has not been playing a strong role in economic development and related Science and Technology efforts. Private sector groups, chambers and the like, have been relatively passive, playing a lobbying role. There is a need to get the private sector to play a more active role.

Public Sector Strategy

Businesses perceive the existence of numerous, uncoordinated government agencies. In some instances it appears there is competition between agencies. Skepticism of government was often expressed by business at the same time as a reliance on government for financial assistance--companies of all sizes look to government before banks or private investors for loans and grants.

Businesses perceive an absence of a consistent strategy and a lack of commitment to implementation. Industry and company targets for financial assistance appear to be constantly changing. There is no consistent application of resources and no follow-through after financial assistance is provided.

Education

Education is a priority at all levels. Some training institutions are not interacting with businesses, while others are and have been praised by business (particularly in Saint. John, Saint. Andrews, Fredericton, Edmunston). Businesses have called for more university coop programs like the one at Waterloo and for stronger continuing education.

Labor Force

Good work ethic and a surplus of semi-skilled and trainable workers are reported attributes in the Southwest. Turnover associated with the seasonality of employment and higher wages are complaints in the Northeast.

Quality of Life

Quality of Life is an asset in the view of some New Brunswickers, but is not believed to be widely recognized as such.

Transportation

Highways and airports are reported to be second class, with rail service unreliable in some areas. This has high cost implications for entering export markets.

APPENDIX F

EXPERIENCE AND STRATEGIES ELSEWHERE

APPENDIX F

EXPERIENCE AND STRATEGIES ELSEWHERE

I. ALTERNATIVE STRATEGIES: OVERVIEW

The number, scope and variety of science and technology related economic development initiatives has grown exponentially in recent years. The recessions of the early 1980s, coupled with structural economic change on national, regional and local levels has spurred the search for innovative economic development tools. Some of these programs develop new technologies. Others promote entrepreneurship. In addition to technology development "institutes" and "centers", a number of other approaches to technology-based economic development are being pursued in various States and are potentially feasible in New Brunswick.

A brief summary of several of the alternative approaches follows:

1. Industry/university partnership programs. When a research center enters into a close relationship with industry, particularly with local industry, the assumption is that the products of research will have commercial application and will result in increased economic activity in the participating firms. This in turn will generate more jobs, more income, and more support services.

2. Research parks. Some research centers have established industrial parks with an emphasis on high-technology companies. These parks differ from the standard industrial park only in that they are located close to the research facility and use that facility as an attraction for companies which presumably can utilize the talents of scientists and technicians.

3. Incubator facilities. By providing physical space, part of the research center itself, where small new companies can be housed and can receive both technical and management services, research centers hope to increase the rate of growth of these companies, thereby enhancing economic development.

4. Venture capital funding. Some research organizations, particularly those established by States with a strong economic development component, include the availability of venture capital for technology-driven ventures as part of the total package. Typically one arm of the organization provides the venture capital below market rates (or at market rates to firms which might well not qualify for commercial loans), while another arm directly supports research at the university level. Other than the organizational link and the common economic development strategy, these units may have little or nothing to do with each other.

5. Business and management services. Some research centers offer management services to fledgling businesses, including those which may evolve from their own research. These may include straight business activities like business plans, accounting systems, and marketing studies, or they may include technical assistance in product and quality control. Oftentimes research centers with incubator facilities, or so-called "affiliated" businesses, offer management services as part of their package.

6. Technology transfer. Technology transfer programs involve efforts to use the expertise of scientific personnel at the research center to directly improve the productivity of existing industry. They may or may not involve utilization of new techniques, new processors, or new products developed by the researchers. In fact, technology transfer can be an effective tool, whether or not there is a major research facility upon which the economic developers can draw. Some examples of technology transfer programs follow:

   a. Industrial liaison. Several major universities (MIT, Stanford) have industrial liaison programs in which industries become numbers. Membership entitles the business to draw on the talents of faculty and other research personnel for specified periods of time and for specific problems. For this service, the businesses pay a fee which may be nominal or may be quite substantial. The fees collected are used to support general research efforts at the universities.

   b. Experiment stations. These stations, typically associated with State universities, provide technical assistance to industries that request it. They may have significant research personnel on staff, or they may draw upon faculty members in the universities.

   c. Business extension services. While these vary in operating methods, the general thrust is to make available to businesses in the State the talents of faculty members at local universities and/or any other personnel who may be able to assist in solving business problems. This differs from the experiment station model in that, first, the extension services generally go looking for businesses that need their services. They may hold informational meetings, may actually call on firms and outline the program, or they may advertise in the media. Second, they generally offer direct services at the place of business. These include a review of business methods, an analysis of similar operations in the same or related industries, and recommendations. Their the same or related industries, and recommendations. Their services may also include the hiring of a particular individual for a short period to work directly with the business.

II. SPECIFIC INITIATIVES: SUMMARY

We have complied a representative, annotated list of science and technology related economic development initiatives in the U.S. and Canada. These are organized first by province and state and subsequentially listed by programmatic category: science and technology research development (product and process development), venture capital/capital assistance, industrial liaison and technical assistance, training and research centers and parks. Combined, the following should provide insight into the scope and variety of existing programs.

A. CANADA

1. By Province

Quebec

Quebec Industrial Development Corporation (Loans, Loan Guarantees, Equity Investments, Etc.)

Quebec Industrial Research Centre

Sherbrooke Industrial Microelectronics Centre (Plans are to establish eight technology centres by 1984; budget $50 million, budget of $6 million approved for robotics -- CAD/CAM centre)

Quebec Department of Industry, Commerce and Tourism

- Innovation Loan Program
- Program for Modernization of Textile, Knitting and Clothing Industry

Investment Assistance Program for Research and Development

Corporation for the Development of Quebec Business Firms: (Tax credits for investment by small and medium sized manufacturers)

Quebec Stock Savings Plan

Alberta

CAD/CAM (University of Alberta)

Coal Mining Research Centre

AOSTRA

Venture Capital Corporation (to complement efforts of Alberta Research Council and Alberta Heritage Foundation for Medical Research)

Edmonton Science and Technology Park

Alberta Opportunity Company (Economic development thrust in manufacturing and processing, provides loans and loan guarantees)

Alberta Agribusiness Loans Program

Small Business Equity Corporation (similar to Ontario's SBDC)

Calgary Research and Development Authority (Calgary Advanced Technology Centre Incubation Centre)

British Columbia

CAD/CAM Centre for Western Canada (proposed by the Western Foundation for Advanced Industrial Technology)

Forest Engineering Research Institute

BC Development Corporation (Loans and Loan Guarantees)

BC Product Development Management Program (Subsidies)

BC Agricultural and Rural Development Subsidiary Agreement (Joint DRIE-BC Program)

BC Assistance to Small Enterprise Program

Venture Capital Assistance Program (planned)

Special Enterprise Zones (planned)

BC Innovation Office

Manitoba

Industrial Applications of Microelectronics Centre (at Winnipeg under STEP)

Food Products Development Centre (at Portage La Prairie under STEP)

Industrial Technology Centre

High Voltage Direct Current Centre (at University of Manitoba)

Communities Economic Development Fund (Small Business Development in Rural Areas)

Venture Capital Program

Saskatchewan

Innovation Place (a Science Park funded by Saskatchewan Economic Development Corporation)

Saskatchewan Economic Development Corporation (loans, industrial sites, building research grants)

Saskatchewan Department of Industry and Commerce

- Various economic development assistance programs
- Business resource centres
- New venture assistance corporation

Venture Capital Corporation (similar to Ontario's SBDC)

Saskatchewan Research Council

Nova Scotia

Applied Microelectronics Institute in cooperation with Dalhousie University, Technical University of Nova Scotia and Nova Scotia Research Foundation

CAD/CAM Centre at Technical University of Nova Scotia ($500,000 from Control Data Canada Ltd.)

Technological Industrial Park at Halifax International Airport

NS Industrial Estates Limited (for small secondary businesses -- 100 percent financing of land and buildings and 60 percent of equipment

NS Small Business Development Corporation (Loans)

NS Department of Development

- Small Business Assistance Programs
- Trade Expansion Program

Cape Breton Development

Nova Scotia Venture Capital Corporations Act

New Brunswick

New Brunswick Manufacturing Technology Centre (at Fredericton)

CADME Microelectronics Inc. (at Fredericton under STEP)

NB Department of Commerce and Development, Assistance to Small Manufacturing and Processing Businesses (interest-free, forgivable loans, technical support)

NB Financial Assistance to Small Business (loans and loan guarantees)

Provincial Holdings Ltd.

Venture Capital Assistance Corporation

NB Research and Productivity Council

Ontario

Technology Centres

Ontario Centre for Microelectronics -- Ottawa
Ontario Centre for Advanced Manufacturing
    CAD/CAM -- Cambridge
    Robotics -- Peterborough
Ontario Centre for Automotive Parts
    Technology -- St. Catharines
Ontario Centre for Resource Machinery -- Sudbury
Ontario Centre for Farm Machinery/Food
    Processing Technology -- Chatham

IDEA Corporation (budget of $107 million over 5 years)

1. Venture capital fund to five technology funds ($65 million)
2. IDEA Research Investment Fund ($13 million, equity position)
3. IDEA Innovation Fund ($13 million)
4. Technology Brokerage Function

Forest Biomass Institute

Ontario Centre for Remote Sensing

Institute for Hydrogen Systems

Fusion Fuel Technology Program of the Ministry of Energy

Urban Transportation Development Centre

Ministry of Industry and Trade Programs

1. Program to Encourage Product and Process Innovation (PEPPI)
2. Product Development Management Program (PDMP)
3. Small Business Industry Technology Program (STEP)
4. Export Assistance Program

Ontario Development Corporation (ODC)

Ontario Energy Corporation

    Energy Technology Business Assessment Group
    Energy Technology Investment Group

Ontario Board of Industrial Leadership and Development

- To set seven small business incubation centres

Small Business Development Corporation

2. By Program Type

Microelectronics Centres

Dalhousie University
Universite De Moncton
University of British Columbia
University of Alberta
University of Manitoba
University of Sherbrooke
University of Toronto

Canadian Industrial Innovation Centre (CIIC)

University of Waterloo
Ecole Polytechnique de Montreal

Centres for Advanced Technology

Institution	Centre
College of Cape Breton	Atlantic Coal Institute
Saskatchewan Research Council	Centre for Advanced Instrumentation
Technical University of Nova Scotia	Institute of Fisheries
McMaster University	Canadian Institute of Metal Working
Ontario Research Foundation	Centre for Powder Metallurgy
University of Toronto	Biomedical Instrumentation Development Unit Micro-electronics
British Columbia Research Council	Centre for Ocean Engineering
University of Western Ontario	Systems Analysis, Control and Design Activity
Nova Scotia Research Foundation	Centre for Ocean Technology
Manitoba Research Council	Canadian Food Products Development Centre
	Health Industry Development Centre
McGill University	Program for the Measurement and Control of Particles and Vapours
University of Waterloo	Waterloo Process Development Centre

Departmental Programs

Industrial Energy Research and Development Program (IERD)
New Crop Development Fund (NCDF)
Energy From the Forest (ENFOR)
Development and Demonstration of Resource and Energy Conservation Technology (DRECT)
Solar Energy Demonstration Program
Energy Research and Development in Agriculture and Food Program (ERDAD)
Conservation and Renewable Energy Demonstration Agreements (CREDA) and Energy Demonstration Program

Federal Government Support for Technology Development

Tax Incentives

Investment Tax Credit
Scientific Research Tax Credit

Financial Assistance for Research and Development

Industrial and Regional Development Program (IRDP)
Industrial Research Assistance Program (IRAP)
Defence Industry Productivity Program (DIPP)
Program for Industry/Laboratory Projects (PILP)

Scientific and Technical Information

Canada Institute for Scientific and Technical Information (CISTI)
Industrial Research Assistance Program (IRAP)

Training Assistance

Skills Growth Fund
National Institutional Training Program
National Industrial Training Program (NITP)

Technology Support Through Procurement

Contracting-Out Policy
Unsolicited Proposals (UP)
Source Development Fund
Profit Policy

Technology Support Through Institutes

Industry Research Associations (IRA)
Industrial Research Institutes (IRI)
Centres for Advanced Technology
National Electronic Facility
Canadian Industrial Innovation Centres (CIIC)

B. UNITED STATES

1. By State

Alabama

Huntsville Alabama Research Park, 1962, $4-6B, 11,000 employees, 35 firms. Space, energy and microelectronics concentration.

Small Business Development Consortium, funded by state (25%), universities (25%) and federal SBA (50%). 12 centers which provide small business counselling and extension across state.

University of Alabama-Birmingham cooperative ventures with industry. Faculty/graduate student teams work with firms to automate and reduce costs. Very successful and widely acclaimed work with GM.

Arizona

Arizona Center of Excellence, 1978, $38M from state over 5 years, $16M from industry, to encourage growth of engineering-based industry.

Arkansas

Arkansas Science and Technology Authority, 1983, $250K, toxicology, medicine and agriculture focus, information.

California

CA Microelectronics Innovation and Computer Science Research Center, 1981, $2M in '83. Administered by intersectoral board through University of California, to promote information systems and microelectronic research.

CA Innovation Development Loan Fund, 1981, $2M federal and $2M state. Loans at below market rates to support development of innovative products.

Worksite Education and Training Act, 1980, $10M from state, additional funds from community colleges. Funds provided to companies to train entry level employees and upgrade skills of existing staffs.

Colorado

Colorado Electronics Institute, 1982, $4M

Connecticut

CT Product Development Corporation, 1975, $7M in 1983. Has sponsored more than 51 products since founding, provides up to 60% of product development costs in exchange for a 5% royalty on product sales ($300,000 limit).

CT Innovation Development Loan Fund, 1980, $1M federal and $1M state. Provides low interest loans to companies located in economically distressed areas which are developing innovative products. Loans must be 100% leveraged.

CT Science Park, 1981, $2M initially, then $350K/yr. from public and private sources for general administration, $25M in private funds for construction. Comprehensive incubator facility, links private developers, university, entrepreneurs.

Florida

Florida Engineering Education Delivery System (FEEDS), 1980, delivers graduate engineering courses by microwave to subscribing companies across state.

Florida High Technology Industry Council, intersectoral, involved primarily in evaluation of vocational education, academic/industry strengths, and building long-term state strategy. University Research and Development Parks (four, also a planned incubator), including the Centrak Florida Research Park, privately financed, to develop the "silicon swamp".

Technical Entrepreneurship Program

Georgia

Advanced Technology Development Center, 1980, currently $500K, links state technical expertise with high technology firms. Administered by Georgia Institute of Technology, which seeks to create incubator facilities and centers of excellence in future.

Georgia Tech Research Institute, $65M, 11% state, rest from research contracts, 600 engineers, research includes business development (utility forecasting, market development), industrial extension (12 field offices to serve small businesses), and environmental, health and safety studies.

Georgia Engineering Technology Program, 1982 ($8M, $750K from state in '85), intended to improve credentials of vocational school faculty, administered by governor-appointed high technology advisory council.

Hawaii

Venture Development Fund, 1979

Illinois

Biomedical Research Park

Illinois Technology Research Institute, 1969, $60M (federal contracts), energy, electronics and defense concentration.

HITS, 1980, $1.65M

Illinois Industrial Training Program, 1981, $600K

Indiana

Corporation for Innovation and Development, 1982, $10M and industry funds, venture capital support for high technology.

Corporation for Science and Technology, 1982, $150M over 10 years, 50% state, 50% federal funds for biotechnology, microelectronics, information processing and flexible automation.

Institute for New Business Ventures, 1983, $6M

Indiana Training for Profit

Kentucky

Kentucky Highlands Investment Corporation, 1973, 500K. Has invested $3M in 13 low-tech start-ups.

Louisiana

Gulf South Research Institute, 1973, polymer and membrane development, primate studies, contract research and technical assistance.

Maine

Maine Science and Technology Council, 1984
Maine Capital Corporation, 1980
Maine Development Foundation, 1984

Maryland

Maryland Engineering Research Center, 1983, small business information, referral and technical assistance

Massachusetts

Lincoln Laboratories-MIT, 1951, $225M, electronics research

MA Technology, Productivity and Innovation Center

Whitehead Institute, 1982, $6M, biomedicine and engineering

Bay State Skills, 1981, $5M

MIT Industrial Liaison Program, 1948, very successful technology transfer to large companies on fee basis

Mitre Corporation, 1959, $240M, electronics research

MIT Polymer Processing Center, 1974, $700K, polymer chemistry

Massachusetts Technology Park Corporation, 1983, $20M

Technology Centers of Excellence

Michigan

Industrial Technology Institute, 1981, $17.5M original seed capital from state, build capacity to assist small and medium sized auto suppliers to upgrade equipment and capital. Now privately funded ($2.75M).

Molecular Biology Institute, $6M

Metropolitan Center for High Technology, $3M

Research Excellence Fund, $25M to reestablish preeminence in higher education.

Michigan Technology Corporation, 1980

Michigan Pension Fund 1983, $350M, venture capital

Technology Deployment Service, $75K to each of 4 universities, in formation.

Minnesota

Wellspring, 1981, $350 start-up, currently 150K/yr. Focus on education, sponsors high technology, energy and general manufacturing task forces, recommends economic development initiatives to state legislature.

Minnesota Microelectronics Information and Science Center, 1979, 1983-85 funding $1.2M from state, $6M from private sources. Sponsors faculty and graduate research fellowships, and seminars.

Mississippi

Mississippi Research and Development Center, 1964, $4.2M

Missouri

Missouri High Technology Skills for Auto Workers, 1982, $18M (joint with GM)

One Stop Shop, administered through state economic development department.

Small Business Development Centers, 6 administered through St. Louis University.

Innovation Centers, $600K for 4 facilities, in formation.

New Jersey

Rutgers Center for Ceramic Research, 1982, $519K, additional state and industry funding for building.

New York

Rensselear Polytechnic Program for Industry/University Cooperation, 1981, $100K, to develop computer industry in NY state.

NY Corporation for Innovation and Development, 1980,

Saratoga Research Center

NY Science and Technology Foundation, 1966, 1982R, $7.5M

SUNY Stony Brook Center for Biotechnology/Biomedicine, 1959, $2M

Cornell University Center for Biotechnology, 1983, $2M

North Carolina

Research Triangle Park, 1959,

Microelectronics Center, 1981, $50M from state, also private sector sponsors.

Entrepreneurial Development Corporation

Biotechnology Center, 1981, $70M, 5 year proposed budget.

Ohio

Thomas Alva Edison Partnership, 1983, $32M
Economic Development Finance Program, 1980, $70M
Ohio Technology Transfer Organization (OTTO), 1979, $1.6M
Industrial Technology and Enterprise Board, 1982, $150K
Development Finance Commission, 1963, $7M

Pennsylvania

Ben Franklin Partnership, 1982, $1.35M in '83, $10.3M in '84,leveraged to $38M through private sector contributions (600 companies). Joint research, entrepreneurial assistance, including 4 advanced technology centers affiliated with universities, and incubator space.

Lehigh University Advanced Technology Center, 1982, $11.4M

PENNTAP, 1965, 150K/yr in state funds, provides technical and other information, emphasis on communication, 1500+ cases per year .

Puerto Rico

Puerto Rico Electronics Industrial Center, 1981, $2.7M

Rhode Island

Rhode Island Greenhouse Program, planning stage, $250M for 7 yrs.
URI Robotics Research Center, 1971, $1.2M,

South Carolina

SC Technology System - Plus "Design for 80's", 1978, 450K

Tennessee

TN Technology Corridor Foundation, 1983, $140K

Texas

Houston Area Research Center, 1980, $5M,
Microelectronics and Computer Technology Corporation,1982, $30-50M
Southwest Research Institute, 1947, $115M,

Utah

University of Utah Research Park

2. By Program Type

Science and Technology Research and Development Product/Process Development

NY Corporation for Innovation and Development
NY Science and Technology Foundation
TX Microelectronics and Computer Technology Corporation
MIT Polymer Processing Center
MA Lincoln Labs
Maryland Engineering Research Center
GA Advanced Technology Development Center
Microelectronics Center of North Carolina
Biotechnology Center of North Carolina
Indiana Corporation for Science and Technology
Michigan Industrial Technology Institute
Michigan Technology Corporation

Michigan Molecular Biology Institute
Minnesota Wellspring
Minnesota Microelectronics Information and Science Center
Pennsylvania Ben Franklin Institute
Colorado Electronics Institute
California Microelectronics Innovation and Computer Science Research Center
Arkansas Science and Technology Authority

Venture Capital/Capital Assistance

Kentucky Highlands Investment Corporation
MA Technology Development Corporation
NC Entrepreneurial Development Corporation
Indiana Corporation for Innovation and Development
Michigan Pension Fund
Ohio Industrial Technology and Enterprise Board
Ohio Development Finance Commission
Ohio Economic Development Finance Program
California Innovation Development Loan Fund
Connecticut Innovation Development Loan Fund
CT Product Development Corporation
Maine Capital Corporation
Hawaii Venture Development Fund
Minnesota Wellspring

Industrial Liaison/Technical Assistance

Rensselear Polytechnic Program for Industry/University Cooperation
MA - MIT Industrial Liaison Program
Microelectronics Center of North Carolina
Indiana Institute for New Business Ventures
Arizona Center for Excellence
Georgia Advanced Technology Development Center
PENNTAP
Mississippi Research and Development Center
MA Technology, Productivity and Innovation Center
Florida High Technology Industry Council
Technology Depolyment Service
University of Alabama - industry joint ventures (eg. with GM)
Missouri One Stop Shop and Small Business Development Centers
Alabama Small Business Development Consortium

Training

MA Bay State Skills
Wake Tech College
Indiana Training for Profit
South Carolina Tech System: "Plus Design for 80s"

Illinois HITS
Illinois Industrial Training Program
Puerto Rico Electronics Industrial Centers
Florida Engineering Education Delivery Service
Missouri High Tech Skills for Auto Workers
California Worksite Education and Training Act
Georgia Engineering Technology Program

Research Centers and Parks

Research Triangle Park
University of Rhode Island Robotics Research Center
Lehigh University Advanced Technology Center
Saratoga Research Center
Rutgers Center for Ceramics Research
Whitehead Institute (MIT)
Gulf South Research Institute (Louisiana)
Southwest Research Institute
NC Biotechnology Center
Michigan Metropolitan Center for High Technology
Central Florida Research Park
Illinois Biomedical Research Park
Illinois Microelectronics Institute/Center (in formation)
Connecticut Science Park
University of Utah Research Park
Huntsville Alabama Research Park
Georgia Tech Research Institute

III. COMPONENTS OF SUCCESS: OVERVIEW

Successful initiatives appear to be distinguished by:

- Articulated focus, targets and priorities;
- Clear eligibility and performance criteria;
- Effective networking and outreach;
- Strong public/private leadership and commitment; and
- Continuity of finance and management.

FOCUS, TARGETS AND PRIORITIES

Too often, economic development programs try to be everything to all audiences. As a result, scarce resources are likely to be spread too thinly. In many cases, it is uncertain in what specific service the program is intended to offer, and to whom.

Successful initiatives have clearly articulated, realistic objectives and are targeted toward specific users/audiences. Planners must choose a limited number of eligible groups, compatible with economic development objectives and consistent with the existing economic base, resources, etc. within the region. Programs which work are designed and administered with clarity and focused upon target groups. Resources are allocated according to pre-determined priorities.

Many states have recently recognized the importance of promoting economic development in sectors with a high potential for growth. The New York State Science and Technology Foundation and the Pennsylvania Ben Franklin Partnership sponsor research in a limited number of technical areas, consistent with the needs of participating industry and local university strengths. The Connecticut Product Development Corporation provides another example of the importance of focus. It has contributed equity to over 51 product development projects, only seven of which have been abandoned.

In Minnesota, the Microelectronics Information and Science Center, sponsored primarily by four major local industries, funds seven technical faculty positions at the University of Minnesota as well as 18 graduate fellowships. The program provides participating graduate students with summer internships in sponsoring industries. These activities enhance research activities in recruiting talented people to Minnesota. The Minnesota Wellspring has pursued a more diffuse strategy by promoting legislative reform and building a labor/management coalition. Its research has prompted the recommendation of three industry tax credit programs to encourage technology transfer to and investment in small businesses.

No matter what strategy is ultimately adopted, its purpose must be clearly communicated to sponsors and participants. For example, the New Jersey Office for Promoting Technical Innovation (OPTI) has been consistently underfunded because of the legislature's lack of understanding of its purpose.

ELIGIBILITY AND PERFORMANCE CRITERIA

Clear definition of eligibility criteria is extremely important to assure efficient allocation of limited resources. The New Jersey OPTI, swamped with requests for financial assistance, spent more time with individual inventors than with businesses demonstrating potential for long term success. As a result, funds were over extended and the program's potential curtailed.

In contrast, both New York and Pennsylvania have chosen to focus their efforts on a limited number of industrial sectors. The Advanced Technology Centers sponsored by the Ben Franklin Partnership deal with four or five specific types of technologies. Selection of technologies is based on available expertise and local industrial mix.

Other state programs offering below market interest rate loans or equity financing require elaborate business plans and private backing. The states provide financial resources to leverage additional private sector investment. Performance criteria used to evaluate the Pennsylvania Advanced Technology Centers measure the extent to which state funds have been able to leverage private contributions.

Successful programs have developed a screening process to limit potential users (i.e., either companies must be developing products using specific types of technologies, or must demonstrate ability to attract matching private sector financing). Other programs such as the Ohio Technology Organization (OTTO), which acts as a broker of technical information, are less restrictive, actively soliciting clients from the business community. The Pennsylvania Technical Assistance Program (PENNTAP) also acts as a broker of information, open to any state enterprise requiring technical assistance. Programs such as OTTO and PENNTAP are monitored by measuring the number of businesses assisted, sales generated and cost savings due to technical assistance.

NETWORKING

Not only must a successful program be well structured and sufficiently funded, it must also be integrated with other economic development programs to achieve its full potential. Pennsylvania has developed a state strategy which integrates its various efforts, as have Ohio, New Jersey, Missouri and others. Though centralized and state driven, the success of the Ben Franklin initiative can be partially attributed to the continued involvement of government, industry and university leaders. All sectors shape the activities of the technology centers, all have a financial stake in them and all are potential beneficiaries. Ohio's OTTO links business councils, chambers and state development staff.

A program's effectiveness is further enhanced by its ability to inform potential beneficiaries of its existence and purpose. PENNTAP and OTTO have actively publicized their activities and services. Other programs have floundered from lack of exposure. Too much publicity and success can result in free-loading: companies able to pay for state provided services may rely on subsidized programs. This potential problem can be minimized by focused outreach and well-defined eligibility criteria.

PUBLIC/PRIVATE LEADERSHIP AND COMMITMENT

Many state economic development initiatives and programs serve as a forum for interested private sector representatives to express and formulate state economic development policy. Programs which encourage and promote private sector management and labor participation are more likely to meet industry and labor needs. Widespread participation increases the credibility of state programs and the potential for continued political support. For example, New York State's Corporation of Innovation and Development has recruited an impressive board of directors from industry. The Connecticut Product Development Corporation and Minnesota Wellspring have assembled broad and representative boards of directors, drawing from state and local government, labor, management, agriculture and education. These boards represent potentially powerful political forces. However, difficult and important issues, such as right-to-work laws and business taxation, are often avoided for fear of dissolution of the coalition. A well integrated board of directors can sacrifice its effectiveness if it lacks strong leadership.

A public-private coalition provides a vehicle which is partially buffered from the cycles of the political process, particularly in cases of strong private sector leadership and genuine incentive for active commitment and participation.

CONTINUITY OF FINANCE AND MANAGEMENT

Programs should be funded in a way to insure continuity of financial resources and management. Programs which rely entirely on state monies are particularly vulnerable: lack of political support may mean cutbacks. For example, the U.S. political process tends to support short-term economic development efforts at the expense of programs which yield long-term results. Funding sources must therefore be diversified.

The Connecticut Product Development Corporation, begun with a $7 million grant, will eventually be self-sustained by royalty fees. The New York Corporation for Innovation and Development, initial funding $2 million, will be self-sustaining through debt and interest payments on loans and returns on investments in equity.

Though not essential, large initial endowments enhance probability of continuous financing and management. The Edison Partnership in Ohio ($32.4 million) the NC Microelectronics and Biotechnology Centers ($50M and $70M over 5 or so years) are sufficiently funded during their initial phases to allow for the development of alternative funding sources. Most states, however, cannot commit such large amounts. Programs like the Central Florida Research Park (entirely privately funded) and Michigan's research institutes (expected to be self-sustaining after 3-4 years) demonstrate the viability and accessibility of diversified funding bases.

APPENDIX G

MEMBERSHIP OF FEDERAL/PROVINCIAL STEERING COMMITTEE AND AD HOC ADVISORY COMMITTEE

APPENDIX G

SCIENCE AND TECHNOLOGY STRATEGY STUDY COMMITTEES

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